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Lime Roasting of Nickeliferous Matte.

BY A. C. DE JONGH.*

On experimenting with pulverized copper-nickel-matte in order to ascertain how far a satisfactory desulphurization of this material could be effected by ordinary means, namely when exposing it to the combined action of air and heat, it came to my mind that the application of finely ground limestone, which in the Huntington-Heberlein and analogous processes has shown itself so eminently useful in accelerating the roasting of lead ore, might prove equally successful in working nickel-copper-matte.

Although the fundamental reactions, governing the lime-roasting processes, cannot be said to have been established, nevertheless it may be considered as a matter of fact, that the eagerness, exhibited as well by free lime as by its carbonate, in absorbing sulphurous gas is the principal feature that marks the first stage of the process. Whether the final expulsion of the sulphur be brought about by a subsequent reaction between oxide of lead and sulphate of lime, under formation of calcium plumbate, as Professor Borchers is inclined to assume, or whether the silica contained in the charge be a decidedly essential constituent, and acting as a stronger acid, simply drives out the SO_3, to form a mixed silicate of lead and calcium (as my own experiments in this line seem to indicate), for the purpose of roasting nickel- or copper-matte this will be of little importance, as neither of the equations involved can be adapted to the case. A combination of NiO and CaO, besides belonging probably to the impossibilities, would not have any advantage, the dissociation of $NiSO_4$ and $CuSO_4$, if occasionally formed, being easy enough, while on the other hand a contamination of the matte with silica would give rise to undue losses of nickel by slagging, and therefore ought to be avoided.

I conclude, that if it be thought to use lime as an accelerating agent in the roasting of matte, we must confine ourselves to the influence it exerts during the first period of the Huntington-Heberlein process, viz., we must aim at generating a purely mechanical mixture of calcium sulphate and absolutely sweet-roasted matte, which can be separated by simply leaching the product with warm water.

Two simple experiments proved that the expectations based upon these ideas were by no means chimerical. A matte, artificially formed in the laboratory and consisting chiefly of NiS and Cu_2S, besides containing a small amount of iron, was finely pulverized (60-mesh) and subjected to roasting. For this purpose 100 grams of the substance were spread out upon a Battersea roasting dish and placed in a glowing muffle, with free access of air. The material was continuously stirred, as far as feasible, with a small iron rod, until it became pasty. Then it was taken out, allowed to cool and pulverized again. A part was reserved and the remainder submitted to heat a second time, until no sulphurous fumes were perceptible. Analysis showed 1.54 per cent. of sulphur remaining, a rather fair figure under the unfavorable circumstances. Then the other part, or half-roasted matte, was mixed with pure, precipitated $CaCO_3$ and treated in the same manner. No sulphurous gas was observed to come off, but after leaching out the CaO and $CaSO_4$, which had been formed, the residue retained only 0.054 per cent. of S. Practically a completely sweet roast had been attained.

I think this process will deserve a trial as to its adaptability, especially in nickel works. Of course, the preliminary calcining must be carried as far as economically desirable, before mixing in the lime. Otherwise an excessive amount of $CaSO_4$ will be formed, which requires an excessively large quantity of hot water to dissolve it. Perhaps it would be advisable to use a MacDougall, or similar, furnace, equipped with a device to secure an intimate contact between the lime and the matte, a short time before they leave the furnace. When the lime, ground to an impalpable dust, is automatically rabbled into the ore, in the hottest part of the furnace, where the air contains the largest amount of oxygen, it will take only a small time to lose its carbon dioxide and to take up the last of the sulphur retained in the matte. If now the mixture be brought into contact with cold water, its physical heat together with the calories, evolved by the combination of CaO and anhydrous $CaSO_4$ with water, probably will prove sufficient to extract all of the lime without the aid of external heat (the most favorable temperature for dissolving $CaSO_4$ being about 30 deg. C.), so that pure NiO and CuO will be left.

*At the Technical University, Delft, Holland

A Remarkable Soda Spring.

BY J. A. EDDY.*

Undoubtedly one of the most remarkable springs in the world has recently been discovered in New Mexico. It is literally a spring saturated with sodium sulphate. Distilled water weighs 8.33 lb. to the gal. The water of this spring weighs 10.66 lb. per gal.; and evaporation yields 3.13 lb. of dry solid matter, of which 83 per cent. is sulphate of soda, crystallizing out chemically pure.

The sulphate of soda crystal contains 57 per cent. water. At 110 deg. F. it melts in its own water of crystallization; and the temperature of the spring being slightly in excess of 110 deg. F., the saturated liquid upon overflowing and cooling immediately forms a crystalline mass like ice.

The natural inquiry arises as to the deposit or accumulation of ages from this spring; for, unless it discharged into a stream of fresh water, the deposit would be vast in extent. No more fitting location could be imagined, for it is in the lowest portion of a vast sink or basin, scores of miles in extent.

The deposit therefore has formed a vast bed, miles in extent, of solid sodium salts, through which this spring, by reason of its heat, maintains its channel and continues to augment the deposit. Inasmuch as the soda crystal effloresces, or gives up its water by evaporation, the elements serve to smooth and level the surface; so that the lake, though dry, is white as snow and bears some resemblance to a Northern lake in the embrace of winter.

It would seem impossible for either animal or vegetable life to exist in this hot brine, or in the dry soda of the lake surface; and yet the brine is inhabited by a minute shrimp-like organism, and a species of plant is often found thriving in the pure white sodium sulphate.

*Denver, Colo.

An Unique Lead Deposit.

BY R. D. O. JOHNSON.*

The Catherine Lead Company, now the Madison Lead and Land Company, whose properties lie near Fredericktown in Madison county, Mo., for several years mined a deposit of lead ore that differs in many points from those that characterize the deposits of the Flat River and Bonne Terre regions, though all belong to the same geological horizon. The Fredericktown deposits are more shallow, smaller, lie closer to the universally underlying porphyry or granite, and might be considered contact deposits; the grain of the galena is coarser, and the rock is more magnesian, is lighter in color, and more dense and brittle. These deposits have been subjected to greater metamorphic action and contain more clay openings and cavities, which latter are sometimes filled with crystallized galena or crystals of oxidized lead ores. The galena is less uniformly disseminated, occurring in bands, seams and vugs.

Though the surface is rolling or hilly, the diamond drilling revealed an extremely rough topography of the ore-bearing limestone. Deeply eroded valleys flanking sharp "hog-backs" are general. All the limestone, except at an occasional low outcropping, is covered with heavy beds of residual yellow clay filled with chert and the silicious remnants of the formerly overlying St. Louis limestone.

At one point, near No. 1 shaft, the limestone stands with almost vertical cliffs about a deeply eroded flat of undetermined area. This depressed region contains a deposit that, so far as this lead district is concerned, is absolutely unique. As shown in the accompanying sketch map and cross section, the shaft was sunk over a ridge of limestone not far from the cliffs surrounding this area. The "west drift," as it is termed, was driven under part of the area and but a few feet below its bottom. At one point *d* the clay was encountered and the hole was promptly timbered up. The drifts *a*, *b* and *c* were driven in ore, but were stopped upon striking the clay. When the workings at the end of the west drift reached out toward the north the clay was again encountered. At each place when the clay was exposed, it was found to contain considerable quantities of lead, but these openings were considered dangerous; it was feared the clay might squeeze into the drifts and cut off part of the mine. The fear was not without foundation, as, at one time, a flow occurred at the point marked *e* that was impossible to control until all the drifts in that immediate neighborhood were filled.

I determined to investigate this deposit and selected the locality *f* as being the most favorable point for the attack. Three drifts radiating from *f* were driven into the clay. This was found to be partly residual and partly infiltrated from above, replacing the formerly existing limestone as the latter was dissolved away by the action of percolating meteoric waters.

The total thickness of the clay to the surface was about 150 ft., but only the lower stratum from 6 to 25 ft. in thickness was found to contain workable quantities of lead. The galena contents varied from 5 to 12 per cent.

Occasional fragments of the original limestone, in some manner protected from solution, were found imbedded in the clay. These fragments usually contained disseminated galena.

It was apparent that the lower portion of the clay deposit represented a part of a formerly existing deposit of galena disseminated in limestone, but that this particular locality had, for some reason, been exposed to a much greater amount of solvent action. The lead ores in the upper portion of the mineralized clay bed are generally massive cerussite, with cores of unchanged galena. The cerussite is sometimes beautifully crystallized. The massive variety is generally colored an apple green, probably due to a small amount of zaratite. All lead ores in this region contain nickel in small quantities. Accompanying the carbonates are brilliant, transparent crystals of anglesite. Much crystallized anglesite is found in vugs in the limestone at the end of the west drift.

Proceeding from the top to the bottom of the mineralized clay bed, the galena becomes less weathered and is found in grains, small veins and slabs imbedded in the clay. There is no evidence of concentration toward the bottom.

The value of the deposit having been satisfactorily demonstrated by the drifts at *f*, the principal drifts were laid off as shown in dotted lines on the sketch map. These were heavily timbered and no ground was mined within 10 ft. of them, and the space between the drifts was divided into rooms. The plan of mining was to dig out rapidly all the galena-bearing clay over a predetermined area, keeping props provided with individual caps close behind the miners. When this had been excavated, the props were withdrawn, the place temporarily abandoned and like operations continued in some remote part of the deposit. After a time, varying from a few days to three weeks, depending upon the firmness of the clay at that point, the excavated room would cave. It occasionally happened that a room could not be completed before symtoms of caving would make their appearance. The room was immediately abandoned. No attempt was made to hold up ground except along the main drifts, which had to be kept open. When the ground had settled subsequent to caving, mining was resumed in the adjacent area. This plan was followed closely and yielded about 90 per cent. of galena-bearing clay over the area mined at a cost far below that of mining an equally productive quantity of rock ore.

The clay was sent two miles to the mill over a Bleichert tramway and dumped directly into the hopper of a disintegrating screen manufactured by the American Concentrator Company, of Joplin, Mo. This washed and separated the coarser parts which went to the crushers and rolls, and mixed the clay and finer portions with water to such consistency that they could be sent directly to the concentrating machines. The slime machines yielded but a very small proportion of the total mill product. Their concentrates were largely carbonate and sulphate of lead.

On this clay ore the mill made a high saving and yielded concentrates averaging over 77 per cent. Pb. By using the disintegrating screen, the mill was enabled to handle the clay ore and the rock ore at the same time without interfering or clogging.

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Illinois Fuel Tests.

One of the first engineering experiment stations established in the country is that at the State University of Illinois. Its equipment includes: Boilers for factory or residences, with plain or chain grates, and induced draft; recording apparatus for testing the temperature and composition of furnace gases; gas producers, calorimeters, etc. The equipment includes boilers aggregating 1770 h.p. A committee has been appointed to work in connection with the local staff; this committe includes representatives from many of the technical societies and commercial interests concerned. The tests will be largely confined to Illinois coals, or those used there. The code of the A. S. M. E. will be used. The tests will cover: The rate of combustion; the effect of size on economy; the effect of thickness of fire; the effect of moisture; the use of chain grates to make escaping gases carry a large per cent. of carbon dioxide; strong draft and thick fire vs. medium draft and thin fire; gain in economy from washed coal, etc. The director is L. P. Breckinridge, professor of mechanical engineering in the University of Illinois.

The Ebbw Vale Steel Company, South Wales, recently installed a metal mixer capable of dealing with 750 tons of metal at a time. The mixer is a boat-shaped contrivance, set on massive steel rollers; a couple of hydraulic rams mounted on trunnions provide the tilting motion and keeps the immense boat rocking from side to side. Ports are provided for gas-firing so as to maintain the temperature of the contents of the vessel.

The Lungwitz Process of Zinc Smelting—I.

BY FRED W. GORDON.

Last fall there was put into operation at Warren, N. H., a blast furnace especially designed to meet the requirements of properly demonstrating the Lungwitz process. This furnace was of commercial size, being 3 ft. in diameter at the hearth, 5 ft. 5 in. in bosh and about 30 ft. high. It was fully equipped with every modern device that advanced metallurgists had suggested, including a Uehling recording pyrometer, a recording automatic composimeter, recording pressure gages, etc.

It was built to resist safely a working pressure of 100 lb. per sq.in. Blast was supplied by a compound-steam, two-stage air compressor of ample size and capable of delivering a continuous pressure of 100 lb. per sq. inch.

Apart from the problem of designing a furnace that might be charged, blown, flushed and tapped while working under a blast pressure of 100 lb., there was much to learn to properly operate it mechanically. Some difficulties were encountered, owing in part to newness of the plant and its design, and to want of familiarity with the unpracticed art. Late in the season it was decided to defer further operations pending some mechanical modifications and the advent of more favorable weather conditions in the spring.

While the furnace was built to withstand a working pressure of 100 lb. per sq.in., it was, with the blowing-machinery and connections, tested to 120 lb. and found all tight and sound. Operations might therefore proceed on the basis of any pressure up to or under 100 lb., while the hearth temperature was held below the corresponding point for ebullition of zinc. As shown by our tests, the hearth temperature might approximate 1500 deg. C. if the pressure be maintained at 100 pounds.

As the pressure employed is for the purpose of restraining ebullition of zinc, the pressure may fall with the temperature. For metallurgical reasons, which will hereafter be shown, the lower the temperature used the better.

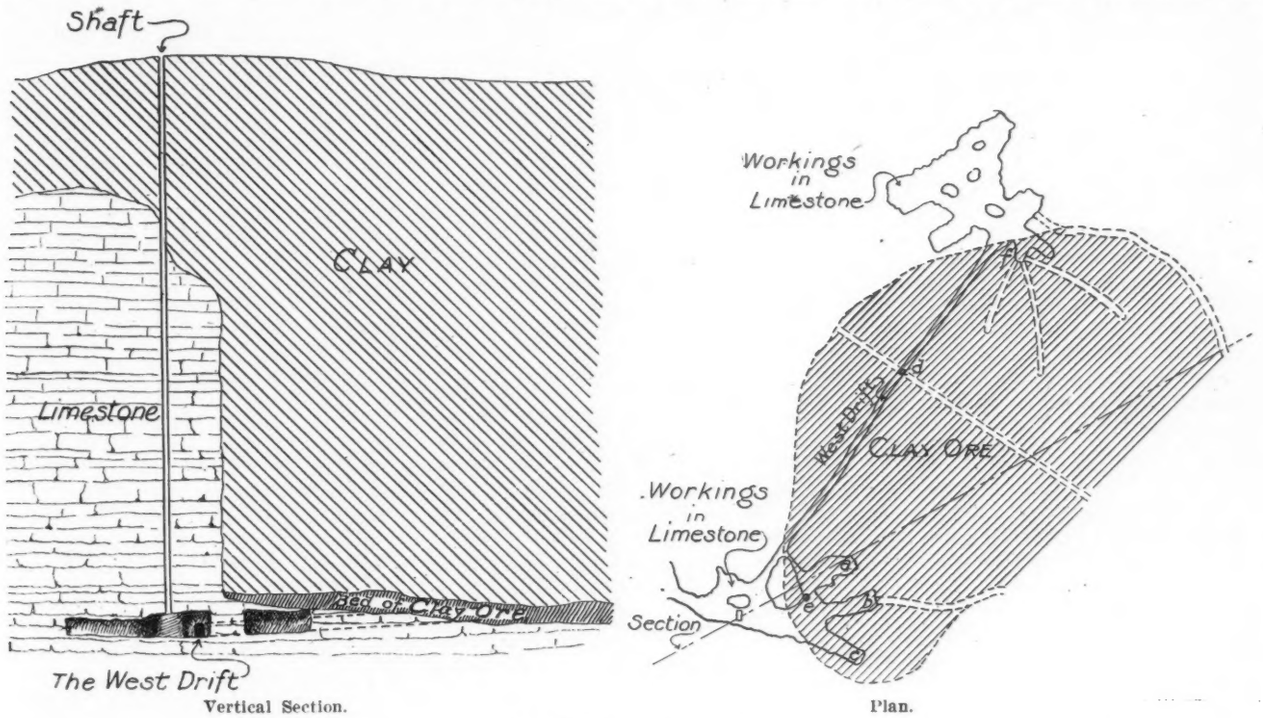
Slags must be formed and kept fluid, and the requisite temperature for this must be maintained. The minimum of the pressure is fixed by the temperature; hence slag requirements control both temperature and pressure, providing only that the temperatures be in excess of that necessary for the complete reduction of the zinc. Slags, therefore, received our exhaustive attention.

It is recognized that zinc cannot be reduced except in an atmosphere of CO + N, with not to exceed, say, 1 to 1.5 per cent, CO_2. If the temperature for good fusion of the slag had to exceed that employed in retorts for zinc reduction and distillation, then iron oxides would be reduced, and would not effect any diminution of the fusion temperature of the slag.

That we might well understand this problem, full and careful analyses of lead-furnace gases drawn from the region of the tuyeres and all the way up to the shaft, were taken at the company's instance from several furnaces while working under good conditions. It is true that analyses of this kind are given by the authorities and in reports, but the subject was of such great importance that actual and reliable determinations by our own people were deemed advisable. Such exhaustive care was taken in the sampling and analyses of these gases that they consistently exhibited the rational phenomena of lead smelting, and the charges in them were such as must take place, due to reduction and dissociation of the descending stock; giving ample proof of their reliability.

It was evident that, though a highly ferruginous slag might be made in the presence of such gases as we found permeating the shafts of these lead furnaces, no such slag could be considered in connection with our zinc operations. If slags of low fusion temperature could be formed by the aid of a small tenor of FeO, then advantage might be taken of the property this oxide has for reducing the fusion temperature of mixtures of acid flux and alkaline earth; otherwise if high temperature slags, and only high-temperature slags, could be formed, FeO must be practically eliminated, because at such temperatures and in an atmosphere under which zinc will completely reduce, ferrous oxide would be reduced to metallic iron.

So far as we could determine, reduction of the iron oxide under these conditions would be effected at a temperature approximating 1500 deg. C., and this coincides with observations upon the reduction of iron in zinc retorts, wherein iron oxide has been subjected to an atmosphere equally as powerful as a reducing agent as that employed in our Lungwitz process, and which did not reduce ferrous oxide



Vertical Section. Plan.

AN UNIQUE LEAD DEPOSIT.

to metallic iron at a temperature of about 1400 deg. C., providing this iron oxide did not exceed 12 per cent. of the slag formed.

We had before us, then, the problem of determining the best composition for slags suitable for: (1) A furnace that might be operated at about 1400 deg. C. at a gage pressure of 90 to 95 lb. and with a minimum of iron oxide. (2) A slag which might carry 10 + per cent. FeO, and be fluid at a temperature not to exceed 1200 deg C., requiring a zinc ebullition-restraining pressure of 50 pounds.

This vast problem was undertaken with a determined spirit; for, with it solved and knowing the pressure necessary to restrain zinc ebullition, the two controlling factors would be definitely determnied, viz.: How high must our temperature be for a given slag? And how high must our pressure be for a given temperature?

Hundreds of different slags were formed and the temperature of their liquefaction accurately determined. Our records would show new and important data on slags. Slags were made in the crucible experimentally with not to exceed 10 per cent. FeO, which fused under 1200 deg. C., and it was proved in our blast-furnace operations that under these conditions FeO did not reduce, but entered and came away with the slag.

Careful and exhaustive study of the authorities failed to disclose information that was satisfactory to us in regard to the various and complex problems likely to be encountered in the operation of this furnace; such, for instance, as:

(1) The rate of drive; e.g. for a given hearth cross section, how much carbon should be burned to CO per unit of time, that the proper temperature for a given burden would result.

(2) The distribution of this combustion to effect, as completely as possible, instantaneous carbonization of the oxygen to the condition of CO only.

(3) That this temperature might be intelligently predetermined, the effect of pressure in restraining zinc ebullition had to be known beyond question.

(4) That the lowest hearth temperature might be employed, it was important to know the temperature requisite for good fluidity in the slags. To obtain this knowledge, it was imperative that a series of tests should be made on slags.

The rate of drive could only be inferentially settled upon by the known rate of gasification, with known burden to a given hearth area, in the best cold-blast charcoal-furnace practice, making pig iron. The temperatures of this iron and slag from said furnace were approximately known. The composition of the slags, the pig iron and waste gases were correctly known. From this data, and with such modification as the difference in the materials and conditions dictated, or seemed rational, we felt satisfied that no material error would result from our conclusions

As to the distribution of atmospheric air with incandescent carbon, at any pressure, that the most effective combustion to the condition of CO only might result, it was held sensible to consider the fullest possible subdivision of the blast without complicating apparatus, and that the velocity of the current of blast from each of the openings should be such as to carry the gases into the mass of fuel, for it is well known that in cupola and lead-furnace practice free oxygen and CO_2 are found in large quantities close to the wall, immediately above the tuyeres. To this end the furnace was supplied with 15 openings for entrance of the blast, each ⅞ in. in diameter, and so arranged that any number of them could be shut off at pleasure.

Published results of experiments made to determine the influence of pressure on restraining zinc ebullition, at various temperatures, were not thought conclusive or to be depended upon. (1) They were not made under conditions at all approximating those we would have to meet. (2) Conclusions as to the ebullition of zinc, derived from relatively low temperatures and pressures, did not satisfy us as to what it might be under very much greater pressure and higher temperature. (3) Nor were we satisfied with results determined in a closed vessel, electrically heated.

It was thought desirable to make these determinations in the presence of (or better, under a pressure from, say) a gas, practically the same as that which would be formed in the furnace, and that, if possible, the pressure applied by this gas should reach the maximum expected to be used in the furnace. With these conditions the maximum temperature without ebullition gave us the precise information necessary. To this end some 300 tests were made. The temperatures determined by the thermo-couple of a Le Chatelier pyrometer ranged from 920 deg. to 1300 deg. C., and the pressures required to prevent ebullition were accurately observed. Each series of tests was plotted in a curve and all curves showed marked similarity. The curves were then averaged to refine our determinations, and from this it was demonstrated that zinc did not boil at 1460 deg. C., at seven atmospheres or 88.2 lb. gage pressure, and that it ceased to boil at 920 deg. C. at one atmosphere, or 0 gage pressure, the average rise being 6.1 deg. C. for each additional pound pressure applied. The curve following the determinations approximated a straight line. The care exercised in this, to us, most important matter gave us the utmost confidence in the results obtained.

As opposed to the views expressed by Lodin and others, the company has faith in the success of the process for reasons which will be shown.

With respect to zinc volatilization, it is sufficient if the liquid be restrained from boiling. Vapor will rise from the liquid and diffuse among the indifferent gases and be non-liquefiable by pressure; but this vapor is of slow formation, and the proper operation of the furnace, continuous charging and constant cooling, will save this vapor, as described below.

Liquid zinc vaporizes from its surface at all temperatures above 500 deg. C., whatever the pressure, within practical limits. The tension with the vapor increases with the temperature, filling the space, so far as gas can fill a space, whether or not that space is occupied by other gases. At the tuyere zone, where temperature is the highest, the weight of this vapor to the unit of space is in excess of any other zone. Higher up, the temperature being less, a vapor of less density is present, until a temperature is reached at which zinc will solidify (415 deg. C.), where zinc vapor cannot exist, except it is carried up by the upward flow of the gases laden with vapor. However, a temperature much below 415 deg. C. is reached, and where the condensation of this vapor, as fume upon the descending and cooler charges, is very rapid; so rapid that waste of zinc in this form would be inconsiderable. This can be better appreciated from the fact that a temperature of 100 deg. C. was maintained under the charging bell of the furnace. The fume adhering to the stock will be carried down, gathering more fume, till the melting point of zinc is reached, when in globules it will drop through the already saturated atmosphere. Due to the high specific gravity, these globules will drop with such rapidity as to pass through an under-saturated atmosphere without volatilization, materially reducing their weight, and any such volatilized zinc will be again intercepted by condensation, if not freezing. This dropping of zinc globules was unmistakably observed during the operation of the furnace.

To augment the cooling of the stock in the liquefying and freezing zone, as explained above, a complete system of external and internal water-spraying has been provided.

A better conception of this may be had from a knowledge of blast-furnace gas-washing failures. These failures were due to insufficient cooling of the gases, which therefore carried with them, into the heating stoves, large quantities of moisture. Assume that a portion of these gases at the temperature they left the washer, say 200 deg. C., and at the humid point for that temperature, should be caused to rise slowly through a tall vertical shaft, and that this shaft is continually and freely charged with absolutely dry material at a temperature of 100 deg. C. View the bottom of this shaft. The hot, wet gases meet what may be saturated material, a little cooler, however, than the gas from which their heat is obtained, and an increment of this moisture is dropped. As the cooler gas rises, yet cooler stock is met and more moisture is dropped, and so

on until the gases with a small quantity of moisture still retained, reach stock that is well below 0 deg. C., when this last increment of moisture becomes snow, adheres to the stock and is carried down, until a zone at a temperature above 0 deg. C. is reached and it melts. This drop of melted snow falls to the bottom, never giving up any vapor as it passes through saturated atmospheres of increasing temperatures. If the current of these gases is very rapid, and the dry, charged material only a little lower in temperature than 0 deg. C., then some moisture might escape. But in the case as put, with —100 deg. C. as the temperature of the charge, a rapid flow can be conceived without much, if any, moisture escaping.

The analogy between this and a furnace shaft, so far as retaining zinc vapor, is all in favor of the latter.

The material charged is absolutely dry as regards zinc vapor. It enters the furnace at 20 deg. C., while the freezing point of zinc is 415 deg. C., a difference of 395 deg. C., instead of 100 deg. C., as in the case of the gas tower.

As to the rapidity of the upward current of gases, carefully weighed analogy between this and other metallurgical processes, especially cold-blast charcoal-iron furnaces doing the best work, indicates that 600 cu.ft. of gas at an average working pressure and temperature should pass through our furnace where its area is 17 sq.ft., at velocity of $600 \div 17$ per minute, equal to 35 ft., or about a mile in 2.5 hours. Scarcely an alarming velocity when the zinc vapor is turning to snow.

From the hearth to the zone of zinc reduction (temp. 1030 to 1150 deg. C.) the only heat requirements are radiation and water cooling; above that, and including zinc reduction, practically all heat appropriations have been made. This reduces the hight of the zone of gasification and extends the hight above it, in which all the real work is done. When the heat required for zinc reduction has been deducted from the gases, the next, and quickly, encounter the limestone, giving off some heat for its dissociation (if the stone has not been charged as CaO), after which their sensible heat is taken up by the stock until their temperature is reduced to 100 deg. C.

Thus in a natural way a long cooling zone is provided, through which a very slow current of gases passes, which readily cool to a temperature of 100 deg. C., their final passage being over stock at an average temperature of not more than 50 deg. C. Due to these mechanical and heat transfer actions, little or no zinc can escape.

If in maintaining the hearth at the proper temperature the escaping gases become too hot, then would the cooling provisions be employed, that liquefaction and freezing might proceed with sufficient rapidity to prevent escape of zinc values in the form of vapor.

In order that the zone of gasification might be maintained at a desired temperature, the heat requirements for preheating the stock, the heat carried away by the escaping gas, reduction, reaction of slag formations, dissociation of $CaCO_3$ (if any), radiation, tuyeres water, etc., were carefully calculated and a margin for contingencies allowed, as variations are sure to occur. Stock will not always descend with desired regularity, and unavoidable difference in the composition of the charge will be experienced; and if working on too close a limit between pressure and the boiling temperature, we may have ebullition of zinc in the hearth, but by this ebullition heat is rapidly absorbed and the resulting vapor is carried up, giving off heat in the upper zones, where the zinc is liquefied or frozen. If this be continued for any considerable time it would cause a noticeable increase in the temperature of the escaping gases when additional burden, slower driving or some other correction would be required to re-establish proper conditions.

Slag-forming materials may be charged as ore or additions; their moisture has first to be driven off, and they are to be heated, and their combined gases, if any, dissociated, by the heat of the ascending gases. CaO, SiO_2 CaF_2, Al_2O_3 will not individually melt at any temperature to be met with in this furnace. We may say, no slag will be formed until these materials are highly heated and brought into juxtaposition; and as low-temperature fusibility depends upon proper proportions of all these slag constituents, good fusion will not occur until they meet together in the hearth.

In laboratory slag-fusion tests it is not possible to effect such thorough preheating preparation or such intimate association of the slag constituents in liquid form as in actual furnace practice.

Case-Hardening Iron.

A new process for case-hardening iron is to add to the iron a small percentage of phosphorus combined with a large amount of carbon. The iron is heated in a tempering powder of bone dust, to which are added 300 grains of yellow prussiate of potash, 250 grains of cyanide of potassium, and 400 grains of phosphorus. The receptacle in which the iron and these ingredients are placed is closed and the cracks filled with clay, and then raised to a clear red or white heat. The material treated is then taken out and plunged, while still hot, into a warm bath. It is claimed that a piece of iron weighing 400 lb. can be hardened to a depth of 0.04 in., and that the iron so hardened can neither be cut nor chipped by the best steel used, although it can be readily welded.

Most of the lime used in colonial days was prepared from shells.

The East Helena Plant of the American Smelting and Refining Company.*

BY O. PUFAHL.

The monthly production of these works is about 1500 tons of base bullion (containing 150 oz. Ag and 4 to 6 oz. Au per ton), and 200 tons of 45 per cent. copper matte. The base bullion is shipped to South Chicago, the matte to Pueblo.

The ore-roasting is done in two batteries of eight reverberatory furnaces and 16 Brückner furnaces, the resulting product containing on an average 20 per cent. lead and 3 per cent. sulphur. The charge for the blast furnaces consists of roasted ore, rich galena, argentiferous red hematite, briquetted flue dust, slag (shells) from the furnace itself, lead skimmings, scrap iron, and limestone.

Four tons of the charge are dumped over a roller into a low car, which is then drawn up an inclined plane to the charging gallery by an electric motor and is then dumped into the furnace.

The two rectangular blast furnaces (Eiler's type) have eight tuyeres on each of their longer sides and cast-iron water jackets of 6 ft. hight. The blast is delivered at a pressure of 40 oz. The lead is drawn off through a siphon tap into a cooling kettle. The furnace has a large forehearth for separating the matte and the slag. The slag is received by a two-pot Nesmith truck, having an aggregate capacity of 14 cu.ft. These trucks are hauled to the dump by an electric locomotive. The shells are returned to the furnace with the charge.

The matte (with about 6 per cent. Cu and the same percentage of lead) is tapped off into iron molds and after cooling is crushed to 0.25-in. size to be roasted in the reverberatory furnaces and smelted up together with roasted ore for a 15 per cent. matte. The latter is crushed, roasted and separately smelted together with silicious ore for 45 per cent. matte, which is then sent to Pueblo to be worked up into blister copper. The small quantity of speiss which is formed is broken up and returned to the blast furnaces with the charge. The slag contains 0.5 to 0.8 per cent. lead and 0.5 oz. silver per ton.

Tin in New South Wales.

At Tingha, in the Inverell district, New South Wales, there are 15 or 16 dredges working for tin, all doing well. They are reported to have from six to ten years' work in front of them. The development of some of the lodes and deep leads of the district is urged. According to E. F. Pittman, the geological conditions of the district are almost precisely similar to those of Cornwall.

*Abstract from a paper in *Zeit. f. Berg – Hütten u. Salinenwesen im. Preuss. Staat.*, 1905, p. 400.

Anthracite Washeries.*

BY GEORGE W. HARRIS.

In the earlier anthracite mining, much coal was wasted, both underground and in the culm-banks on the surface. Such waste is common in the development of new mining districts, in which, as a rule, only the richest material can be profitably treated. In the anthracite region, special causes helped to increase this evil. The mines were generally operated under 20-year leases, and royalties were paid upon such coal only as was actually marketed. The lessees consequently cared for immediate profit only. They were not bound to win all the coal they exposed, or to leave it in such condition that their successors could win it. Nor was it their interest or duty to educate consumers in the use of their product. The market called for coal of large sizes; and such coal they furnished, throwing away the rest. Any pains taken by them to bring about a more rational use of coal by their consumers would have borne fruit, after their leases had expired, to the benefit of somebody else.

A full statement of the situation was given in 1893, in the report of the State Commission, appointed in 1889 to investigate the subject.[1] That body included the late Eckley B. Coxe, Heber S. Thompson and William Griffith.[2] Its report gives special attention to the utilization of the old culm-banks.

Meanwhile, this colossal waste, both below and above surface, of a valuable and limited national treasure, had received its first check through the concentration of the control of the anthracite mines in the hands of a few wealthy firms and corporations, which had both the motive and the means for measures of economy looking to a more distant future, and were guided by intelligent men, who knew the value of scientific advice.

The consequent improvement of mining methods, by which the unnecessary waste of coal underground was stopped, is outside the limits of this paper, which is concerned with the waste in the breaker, represented by the old culm-banks.[3] The first step toward the diminution of this waste was the commercial introduction of smaller sizes of coal. This required the education of consumers to the use of such sizes. "Pea," "Buckwheat," "Buckwheat, No. 2" ("Rice") and "Buckwheat, No. 3 ("Barley") achieved successively recognition as articles of trade. The rapid increase in the production of the sizes below chestnut is shown in Table I, taken from a report by H. H. Stoek,[4] and brought up to date by *The Mineral Industry.*

THE PRODUCT OF SMALL SIZES OF ANTHRACITE FROM 1875 TO 1904.

Sizes	1875	1880	1885	1890	1895	1900	1903	1904
All sizes.....	20,000,000	23,500,000	32,000,000	37,000,000	46,500,000	51,500,000	59,462,831	57,492,522
Lump, Steamer, and broken..	7,500,000	9,000,000	7,500,000	9,000,000	8,000,000	7,500,000	7,128,613	5,426,611
Egg and chestnut.....	11,000,000	11,500,000	18,500,000	19,000,000	24,500,000	26,000,000	19,178,324	18,927,793
Chestnut and larger.....	18,500,000	21,000,000	26,500,000	28,500,000	32,500,000	33,000,000	a 37,838,510	35,636,661
Pea.....	1,000,000	2,000,000	3,500,000	4,500,000	6,500,000	7,500,000	7,929,715	8,057,268
Pea and smaller	2,000,000	3,000,000	6,000,000	8,500,000	14,000,000	18,000,000	21,624,321	21,855,861
Buckwheat and smaller.....	150,000	500,000	2,000,000	3,500,000	8,000,000	11,000,000	13,694,606	13,798,593

(a) Including stove-size.

The reports of the collieries of the Girard Estate show that small sizes of coal were thrown upon the dump prior to 1866, at which time chestnut was the smallest size sent to the market. In 1867, pea coal was utilized for fuel; in 1878, "buckwheat" was shipped; in 1895, "rice;" and quite recently "barley." No record of shipments of culm or coal-dust from the Girard Estate collieries was made prior to 1902.

A fair estimate of the quantity of coal and coal-dirt sent to the culm-banks from the commencement of mining operations up to 1903 is about 315,700,000 tons, or 35% of the total production during that period.

The different conditions of mining in the anthracite regions have affected largely the character of the resultant culm-banks. In the middle and upper portions of the Lackawanna region, from near Wilkes-Barre to Forest City, the seams have little pitch, and most of the loose rock resulting from mining operations was left in the chambers; while in the steeper seams of the middle and southern regions, practically the entire product of the mine was frequently loaded in cars and sent to the surface, the rock and much of the coal-screenings being placed in the same dump. Moreover, the dry preparation of coal in the Lackawanna region tended to a greater saving of the smaller sizes, which were stocked in banks. On the other hand, wet preparation in other regions was more wasteful to the fine sizes, much of the mined coal being carried away and lost in the water used in washing. In other instances, the culm was spread over many acres of ground, destroying vegetation and generally contributing to the barrenness of tracts already denuded of timber. Under these conditions the recovery of the smaller sizes of coal became difficult, if not commercially impracticable. These circumstances indicate the Lackawanna region as the natural field for washery operations; and it is in the Lackawanna and Wyoming valleys that the greatest development of this branch of the coal industry is found.

During 1903, the shipments of coal from washeries[5] amounted to 3,677,909 tons of which quantity, 2,875,981 tons (78%) came from the Lackawanna region, and 309,244 tons from the Pottsville districts. This output from the washeries constituted 5.92% of the total quantity of coal sent to market in that year.

In general, the machinery and some of the methods used in washeries do not differ materially from those seen in portions of breakers preparing the smaller sizes of freshly mined coal; in fact, the washery is often an annex to an old breaker in which the coal is prepared dry. The important difference is that the washery is essentially "wet:" the success of this practice being largely due to the abundant use of water, which not only removes clay and coal-dirt, but greatly assists in the separation of the various sizes on the screens.

Starting at the culm-bank, the first step in the operation is to transport the material to the washery. The culm is fed to conveyors by hand or by steam shovel; then loaded into cars, which are hoisted to the top of the washery; or, as is becoming common practice, it is flushed into conveyors by means of a horse, as in hydraulic mining—a stream of 2.5-in. diameter being sufficient to carry the culm to the conveyors in sheet-steel chutes placed at a slight angle to the horizontal. (Fig. 1.) As the bank recedes, the chutes are taken up, the underlying culm is shoveled into the conveyor, and the scraper line is moved closer to the bank. Generally, there are several lines of conveyors, the one nearest the washery being permanent, and the others feeding into it movable. A difficulty often encountered in working these banks is the occurrence of ashes, from the boilers of former times, which have been mixed with the coal on the bank. The separation of these ashes from the valuable portion of the dump is often an expensive operation.

This general practice of flushing into

* From *Bi-Monthly Bulletin*, No. 6 (Nov., 1905), of the American Institute of Mining Engineers.

[1] Report of Commission Appointed to Investigate the Waste of Coal-Mining, with the View to the Utilizing of the Waste, May, 1893.

[2] For a statement of Mr. Coxe's great services in this respect, see Dr. Raymond's Biographical Notice of him, *Transactions* of the American Institute of Mining Engineers, XXV, 448; also, for further information, *Ibid.*, I, 9, 55, 59, 406; III, 13; V, 417, 465; IX, 294; XI, 7; and sundry volumes of the Pennsylvania Geological Survey, especially A (1881), on "The Causes, Kinds and Amount of Wash in Mining Anthracite."

[3] The recent accumulations of that class are by no means so valuable as the old ones.

[4] "The Pennsylvania Anthracite Coal-Field," 22*d Annual Report*, United States Geological Survey, 1902, Part III, p. 55.

[5] *Report* of the Department of Mines of Pennsylvania, 1903.

conveyors is followed at the Capouse washery of the Scranton Coal Company in the Keyser valley, north of Scranton, on the New York, Ontario & Western railroad. This company also operates the Mount Pleasant washery at Scranton, and the Raymond washery at Archibald.

At the Capouse washery, there is a fixed scraper line, 380 ft. long and a 500-ft. movable conveyor, each driven by an independent 10- by 16-in. Nagle engine. These endless-chain conveyors run in a framework, the bottom line moving in a sheet-steel or cast-iron trough and returning on T-rails overhead.

FIG. 1. FLUSHING CULM INTO THE TROUGHS WHICH FEED THE CONVEYORS.

The conveyor delivers the fine material at the foot of the main elevator of the washery, where it is washed, sized, the slate removed and the large pieces of coal rebroken. A typical plant for handling culm containing few pieces of large size is illustrated in Fig. 2.

The washery, having a capacity of 120 tons of prepared coal per hour, occupies an area of about 53 by 65 ft. at the foundations, and is approximately 80 ft. high. Fig. 3, 4 and 5 show the details. The frame of the building is morticed with 12 by 12-in. posts braced with 8 by 8-in. timber. The stringers supporting the machinery and those under the coal-pockets are of 12 by 12-in. oak. The compactness of this plant is quite striking when compared with coal-breakers having a similar capacity. In marked contrast also is the absence of the clouds of coal-dust which arise during working hours at the breakers in the Lackawanna region.

The preparation of the coal at the Capouse washery begins at the point where the scraper-line discharges into a chute leading to the main elevator. A man stationed here throws out large lumps, breaks those containing coal into smaller pieces, which are then thrown into the elevator-boot, *A* (Fig. 5), removes any pieces of foreign material—wood, iron, slate, etc., and controls the feed of the coal to the elevator. In the washery, the main elevator is 65 ft. long, and carries 71 water-tight buckets, each 12 by 28 in. The elevator discharges into a chute, *B*, which feeds the first shaking-screen, *C*. In washeries the revolving, circular screen has been almost entirely superseded by those of the flat shaking type because the fine mesh of the former becomes clogged with dirt, despite all efforts to prevent it.

The shaker or "mud" screen, *C*, consists of three screens, the top one being 27 by 6 ft. and the two others 20 by 6 ft. in area. The screens are driven by eccentrics, set so that each one receives a thrust at a different time from the others, an arrangement to avoid undue vibration of the framing. As soon as the material strikes the top screen it is sprayed with water from a perforated pipe; and, passing down the screen, goes under a box from which a copious stream of water overflows. The first 21 ft. of the top screen has 1.5-in. round holes, through which pass chestnut and smaller size pieces to the screen below. Next to the 1.5-in. round holes are placed angle-iron, having the angle uppermost, the edges spaced 0.75 in. apart, which allows flat pieces of slate to fall through. The last 4 ft. of the top screen has 2.-in. round holes which permit pieces the size of stove coal to fall through to a chute; pieces larger than 2 in. pass over the end of the screen to another chute. The stove coal goes to jigs, *D*, thence to rolls, *E* and *F*; and, after being broken to pea size and smaller, to the main elevator-boot, *A*.

The large coal is hand-picked by six men and boys and the slate removed, after which it is sent to the rolls and the main elevators. The coal that drops through the top screen of the shaker, *C*, falls on to the second screen having ⅞-in. holes, the chestnut size passing over, and pea and smaller sizes dropping through to the lowest screen. The chestnut size goes to jigs, *G*, thence to rolls, *E* and *F*. The bottom screen has 0.1-in. holes which permit the fine coal-dirt, slush or culm (it is called by all three names) and mud to pass through to a trough which delivers to a settling-pond near the washery, where the stream spreads over a large, neartly level area and deposits the suspended materials. The pea size and smaller sizes of coal pass over the bottom screen to a second shaker, *H*.

The shaking-screen is simple in construction, effective in action, occupies little space and needs few repairs. At the Capouse washery, each screen is suspended from ⅞ by 8-in. ash boards, their upper ends bolted to overhead beams and the lower to castings which journal on bars passing under and supporting the screens. The two boards on each side are set at an angle from the vertical so that they act as braces and prevent the screens from swaying sideways. When suspended by rods, the screen travels between guides to insure greater steadiness. Both methods of suspension are used, the boards having the preference.

The shaker, *H*, consists of four tiers of screens, the top one having an area of 30 by 6 ft., the next lower 26 by 6 ft., and the

two lower being 20-ft. long by 6 ft. wide. The coal passing through this shaker in separated into sizes as follows the top is separated into sizes as follows: The top screen with 0.5-in. mesh allows the pea smaller to drop through; the next screen, with 0.375-in. mesh, separates No. 1 buckwheat from the smaller sizes, the latter dropping through to the next lower screen with a ¼-in. mesh; this last screen makes No. 2 buckwheat or rice coal; No. 3 buckwheat or barley passes over the lowest screen which has 3-32-in. mesh, through which drops the fine coal to be carried by the wash water to settling pond No. 2. The wisdom of keeping the mud from the shaker, *C*, separate from the fine coal of the shaker, *H*, when possible, will be more apparent as time goes on, and this fuel becomes valuable as material for briquettes or for burning as dust.

The three buckwheat sizes from the shaker, *H*, go direct to pockets, but the pea coal must be cleaned of slate. After the pea sizes leaves the top screen it passes down a chute, in which is a triangular device raised about 0.5 in. above the bottom, so as to allow flat pieces of slate to pass under while the coal goes to the elevator, *J*, and so to the jigs, K. After leaving the jigs the coal passes through a Pardee spiral picker for further cleaning and thence to a pocket.

A number of features about this washery are deserving of special mention. The six jigs (of the Christ type and measuring 11 ft. by 5ft. 4 in. by 6 ft. 9 in.) are driven by a 7 by 8 in. engine. The coal receives a reciprocating motion in a pan immersed in water, which action causes the slate to sink, while the lighter coal passes out at the top. Generally three jigs are sufficient to clean the coal, the others being held in reserve. The larger-mesh screens on the shakers are of steel, but those of 0.1 mesh, on account of the small perforation, must necessarily have thin metal to prevent clogging and therefore are made of bronze in order better to withstand the action of the acid mine water used in washing the coal. At the Capouse washery, the shaker, *H*, has, above the tier of screens, four overflow water-boxes, which are very efficient.[6]

The shaker, C, receives from 165 to 170 thrusts per minute and the shaker, *H*, about 180. To re-break large coal to pea size and smaller, two rolls are used, the roll, *E*, being 24 by 24 in., and *F*, 21 by 24 in. The two rock rolls shown in Fig. 5 were used to crush slate taken from the coal, to a size not larger than pea, which was then sent with the fine coal to fill old mine workings, a method since abandoned at the Capouse washery.

As previously noted, a large quantity of water is most important for successful washing, and the supply for the Capouse washery is obtained from an adjacent shaft. A bull pump raises water from the mines and delivers it to a reservoir near the washery, the pumping equipment of which consists of three No. 10 Knowles pumps, 16 by 10 by 16 in. It is estimated that each pump furnishes 500 gal. per min.; two pumps raise water to the top of the washery, through their two 6-in. columns which connect at the top; the third pump supplies water for flushing the material into conveyors at the culm-bank. All water pipes about the plant are at such an angle that when work stops, valves are opened and the water drains out, thus preventing the pipes from freezing up in cold weather.

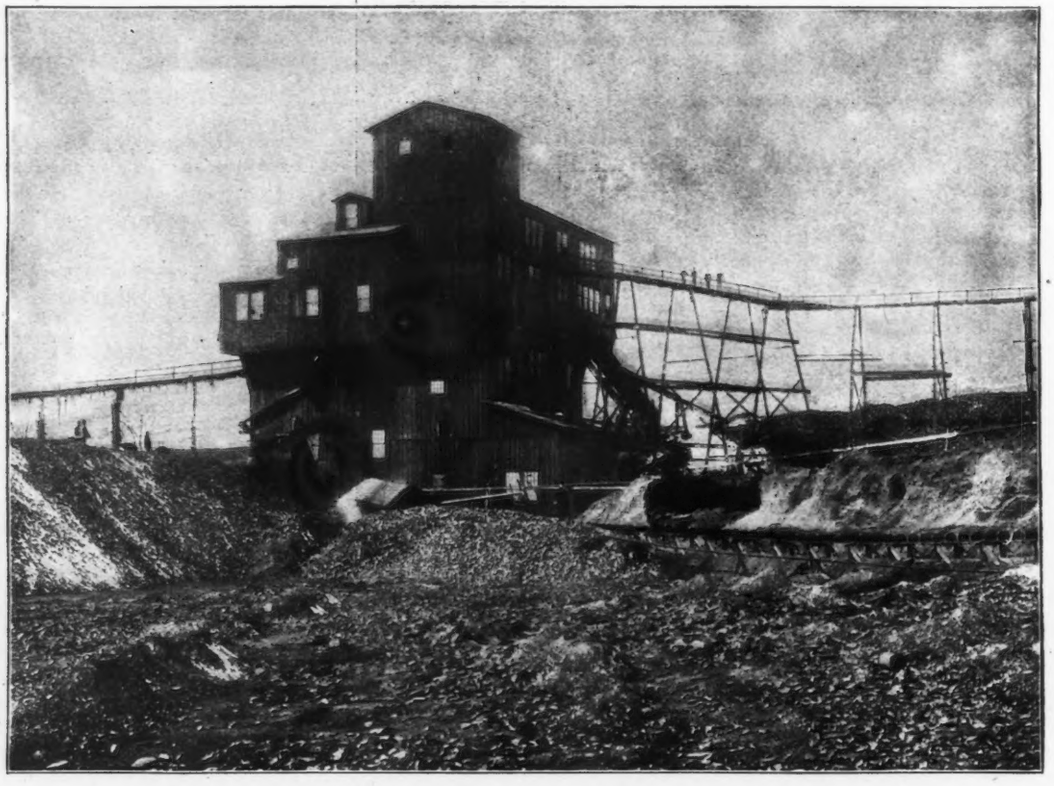


FIG. 2. CAPOUSE WASHERY—PLAN, SHOWING THE POSITION OF THE MACHINERY.

The machinery is operated by a 24 by 24-in. Dickson engine, running at 78 rev. per minute. The steam is supplied by three fire-tube boilers, housed in a substantial brick building, situated at a distance of 500 ft. or more from the washery. The labor required to run the plant consists of from 40 to 50 men and boys, a larger number being needed in winter than in summer, to clean out railroad cars. The outside force includes a foreman in charge of the whole plant; 2 hose men; 10 or 12 men on conveyor lines; 2 men to run the conveyor engines; 1 man at the elevator boot; and 2 men at the settling ponds. The force inside the washery is distributed as follows: one machinist or oiler; 1 carpenter or repair man; 3 jig

[6] A similar shaker at the Bellevue washery is equipped with a different device. A pipe carries the water close to the coal on the top screen; and a piece of sheet-iron fastened to the pipe directs the water in a flat spray against the direction of the moving coal. This retards the coal and turns it over, thus facilitating the sizing and cleaning. Four sprays, equally distributed along the length of the shaker, are used for this purpose. The shakers have a pitch of 1 in 12, and receive a thrust or reciprocating movement of 5 in. from the eccentrics connected at the upper end.

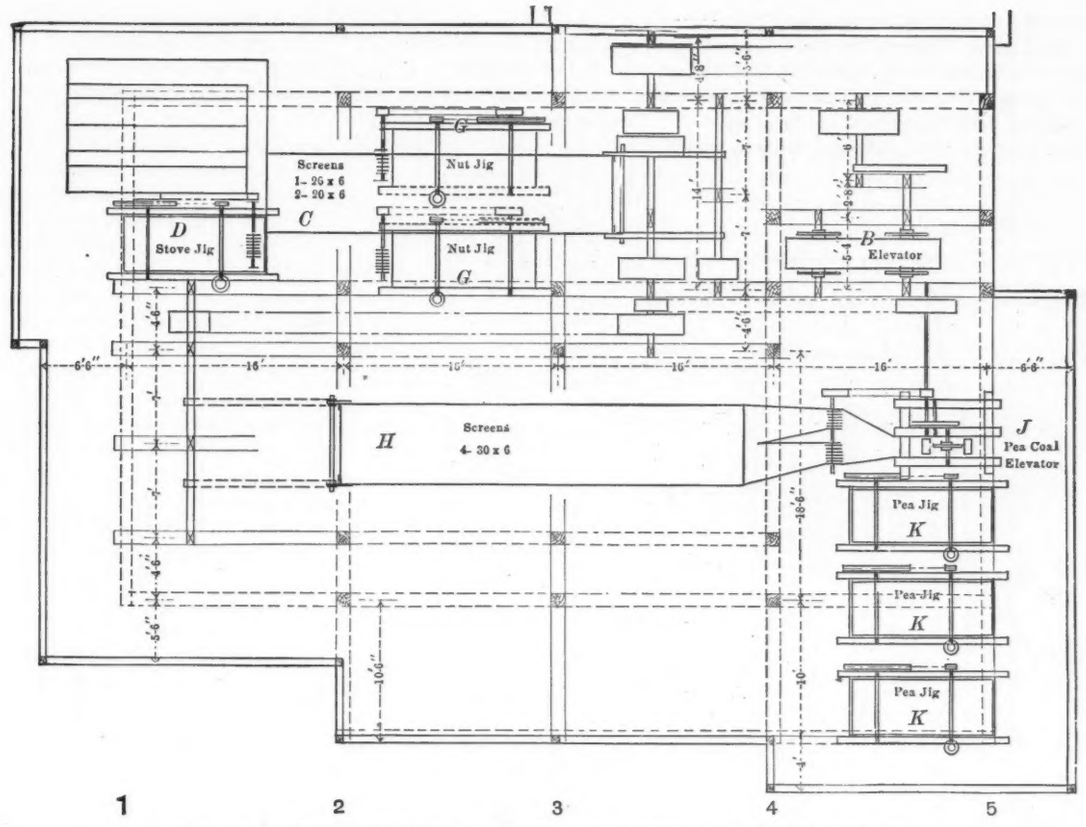


FIG. 3.—CAPOUSE WASHERY—PLAN, SHOWING THE POSITION OF THE MACHINERY.

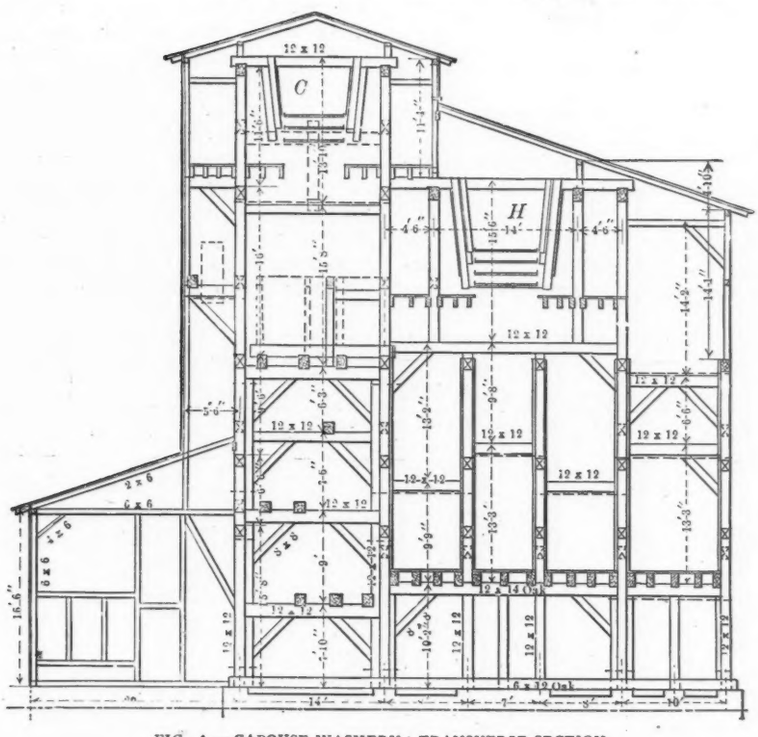


FIG. 4.—CAPOUSE WASHERY; TRANSVERSE SECTION.

runners; 8 slate pickers; 1 engineer; 1 man at the head of the main elevator; 4 loaders; 2 car repair men; 6 slate dump men. In addition, there are at the boiler-house 3 firemen; 1 man to cart out ashes, and 1 man to wheel in coal. The Capouse plant has shipped coal since November 1, 1900, and during 1904 worked 182 1-3 days of 9 hours each, producing 184,005 tons. The record for the washery was made in January, 1902, when 31,018 tons were produced in 262½ hours.

In the Capouse plant, which makes pea and buckwheat, the machinery for removing slate consists of 6 Christ jigs and 1 spiral picker, through which the large coal is cleaned before going to the rolls. A different method is followed at the Nottingham washery of the North American Coal Company, of Plymouth, a plant making 6 sizes of coal, from stove to No. 3 buckwheat (barley). At the latter plant 11 Pardee spirals and 1 Emery picker are employed to remove the slate mechanically. There are also other important differences. The Nottingham washery contains 3 shakers and 3 pairs of coal rolls. The large coal from the first shaker or mud screen, after being hand-picked, is sent direct to the rolls, and finally cleaned of slate in the spirals just before going to pockets. The first or mud screen sends pea coal to pocket, the second shaker makes three sizes of buckwheat and the third shaker produces stove, nut and pea coal. This plant employs on an average 58 men and 18 boys, and has a capacity of 100 tons an hour. The Nottingham culm bank contains a considerable amount of large coal, which is not recrushed as fine as at other plants.

The Schuykill Washery belonging to the same company embodies features peculiar to the handling of culm banks containing larger pieces of coal (or coal and slate) than either of those above noted. At the Schuylkill works, men with sledges break up the largest pieces at the bank before the material is flushed into conveyors. Before passing into the washery proper, the coal goes to a shaking screen with two

decks, the upper of which has 5.5-in. and the lower 2.75-in. mesh. Everything dropping through this shaker passes direct to the main elevator. The two grades of large coal passing over the screens go to separate chutes, where men pick out the slate, after which the coal goes to rolls, is broken to egg size and smaller, and then passes to the main elevator.

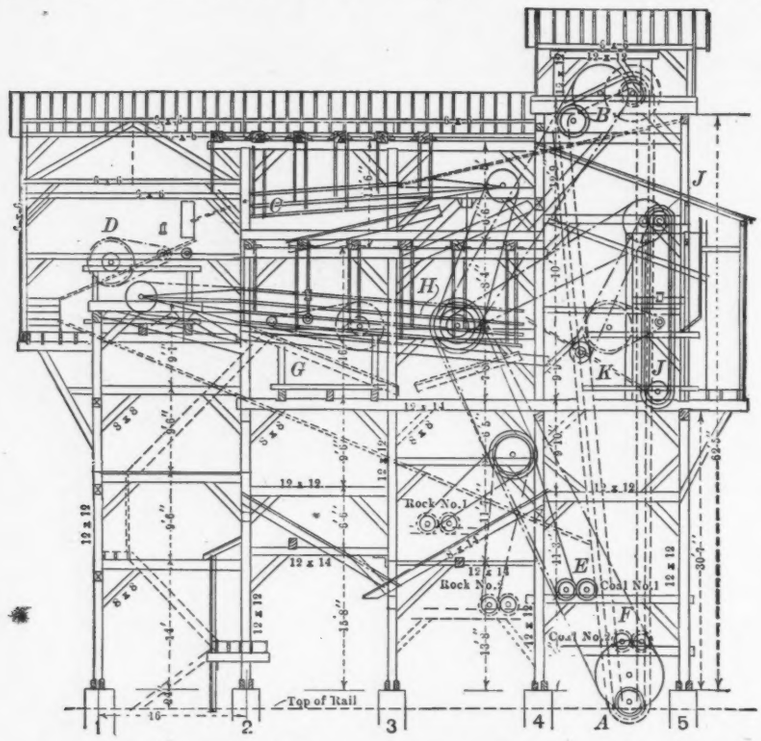


FIG. 5. CAPOUSE WASHERY (PARTLY IN ELEVATION). LONGITUDINAL SECTION.

An interesting feature of the Delaware, Lackawanna and Western washeries is the mechanical method used for ascertaining the percentage of slate in every car of coal shipped. As a car is being loaded, samples of coal aggregating 10 lb. are taken at different intervals and thoroughly mixed; and 3 lb. taken therefrom are placed in a perforated copper pail. The pail is then suspended in an earthenware jar containing sulphuric acid, of a specific gravity half-way between those of coal and slate. As a result, the coal floats on top and is skimmed off, while the rock and slate, sinking to the bottom of the pail, are withdrawn from the liquid and weighed. The weight of the impurities, compared with the weight of the 3-lb. sample taken, gives the percentage of slate in the coal.

In some instances, particularly in the Schuylkill region, the culm bank is loaded by a steam-shovel into mine-cars, which are hoisted up a plane to the top of the washery and then dumped. Here the material may pass over bars and the large pieces may be handled on a platform, as in breakers.

In many washeries the "bony," or pieces of mixed coal and slate, constituting the middlings between clean coal and clean slate, are rebroken and sent over the screens a second time, thereby recovering a considerable quantity of good fuel.

In general it is interesting to note that of the 13 coal-producing operations of the Girard Estate during 1903, two are classed as washeries; yet of the 11 collieries, the production of two came in 1903 almost entirely from culm banks, and 6 others very materially augmented their output from this source. Thus the 2 washeries shipped 230,039.18 tons or a little more than 15%, while coal reclaimed from culm banks formed 30.7% of the total shipment of 1,515,213 tons from all the operations of the Estate.

The proportions of the various sizes of coal found in culm banks varies in the different banks and also at times in the same bank. The adjoining table shows the shipments from a number of washeries throughout the anthracite field, and gives a fair idea of what is generally reclaimed. While this table gives the coal produced from the banks, it does not generally indicate the sizes going to the washery; for in most cases the larger pieces are rebroken. For example, the Delaware, Lackawanna and Western makes nothing larger than buckwheat size at the washeries, everything in the banks being broken to that size and smaller.

Washery coal appeals to the operator and the engineer, as well as to the consumer of fine coal, particularly in cities. The operator sees in these large accumulations from former mining operations a great quantity of coal readily available for quick shipment when occasion demands. During the anthracite strike of 1902, these washeries, being comparatively easy to operate, and requiring a relatively small number of men, mainly unskilled, were for months the only productive source of hard coal. Large shipments from these plants were made for some time after the mines resumed; and for this cheap supply of smokeless fuel there was a great demand from steam-users in many neighboring cities. From an engineering standpoint, the reclaiming of coal from culm banks is gratifying, because it recovers value from the great waste which attended the early mining of anthracite.

SHIPMENTS OF COAL FROM WASHERIES

Name of Company or Washery.	Size of Coal.								Total.
	Egg.	Stove.	Nut.	Pea.	Buck-wheat.	Rice.	Barley.	Culm	
	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons
Scranton Coal Co. (1904)									
Capouse Washery	.....	.....	.....	9,483.12 (5.15%)	57,785.15 (31.41%)	41,112.13 (22.34%)	75,622.07 (41.10%)	.....	184,002.47
Mt. Pleasant Washery	.....	.....	.....	13,725.13 (6.93%)	41,851.18 (21.11%)	51,320.17 (25.89%)	91,321.07 (46.07%)	.....	198,217.55
Raymond Washery	.....	.....	.....	14,755.16 (7.48%)	54,546.16 (27.64%)	52,227.01 (26.46%)	75,816.18 (38.42%)	.....	197,344.51
North American Coal Co. (1903)									
Schuylkill, No. 1	.....	8,400.90 (4.83%)	17,082.55 (9.81%)	25,472.85 (14.63%)	63,321.85 (36.38%)	48,514.65 (27.87%)	11,164.55 (6.42%)	129.70 (0.06%)	174,087.05
Raven Run Coal Co. (1903)	.....	.....	5,390.70 (9.64%)	10,084.20 (18.02%)	22,157.70 (39.60%)	18,320.25 (32.74%)	.....	.....	55,952.85
Girard Colliery (1903)	169.75 (0.33)	1,403.85 (2.71%)	4,691.30 (9.06%)	16,725.30 (32.32%)	16,951.75 (32.76%)	11,808.85 (22.82%)	.....	.....	51,750.80
D., L. & W. R. R. Coal Dept. (1904)	.....	.....	.....	.....	196,250.00 (25%)	274,750.00 (35%)	314,000.00 (40%)	.....	785,000.00
	.....	.....	.....	.....	.....	.....	.....	.....	.....

Brimstone versus Pyrite for Wood-Pulp Manufacture.

BY ERNST A. SJÖSTEDT*.

In an article with the above heading which appeared in the JOURNAL of Dec. 23, 1905, Herman Frasch, president of the Union Sulphur Company, New York, discussed the relative value of brimstone and pyrite for sulphite pulp, from the point of view of the sulphur miner. There are generally two sides to a story, however, and as one only has been shown, I will now turn up the opposite side and show what it will reveal in the light of actual experience in using both brimstone and pyrite in the manufacture of a bisulphite liquor for the sulphite mill.

To present intelligently the comparative value of brimstone and pyrite for sulphite-pulp making, it is essential, first, to clearly establish the fact that both of them can be made to yield suitable gas for the preparation of a bi-sulphite liquor of required strength and quality. In order to do this, let us see what percentage of sulphur dioxide in the gas is obtained, in burning brimstone in a sulphur burner, and in roasting pyrite in a modern roaster. Theoretically, when burning sulphur or pyrite with the required amount of oxygen, the following reactions are taking place:

$S + 2O = SO_2$; that is, all the oxygen combines with S to form SO_2.

$2\,FeS_2 + 11\,O = Fe_2O_3 + 4\,SO_2$; or 8 parts oxygen out of 11 units combine with S to form SO_2.

But when the oxidation is accomplished by means of air (containing only 21 volume-per cent. of oxygen) the highest theoretical percentages of SO_2 obtainable are the following:

When burning sulphur (S): $21 \times 2 \div 2 = 21.00$ per cent. SO_2.

When burning pyrite (FeS_2): $21 \times 8 \div 11 = 15.27$ per cent. SO_2.

Comparing sulphur with pyrite, we find, therefore, that the theoretical maximum yield of sulphur dioxide in the gas made from the former is 21 per cent.; and that made from the latter only 15.27 per cent. In practice, however, the percentage of sulphur dioxide obtained in the brimstone gas is usually between 12 and 16; while in roasting pyrite fines in a modern roaster, a 12 to 14 per cent. gas is readily maintained.

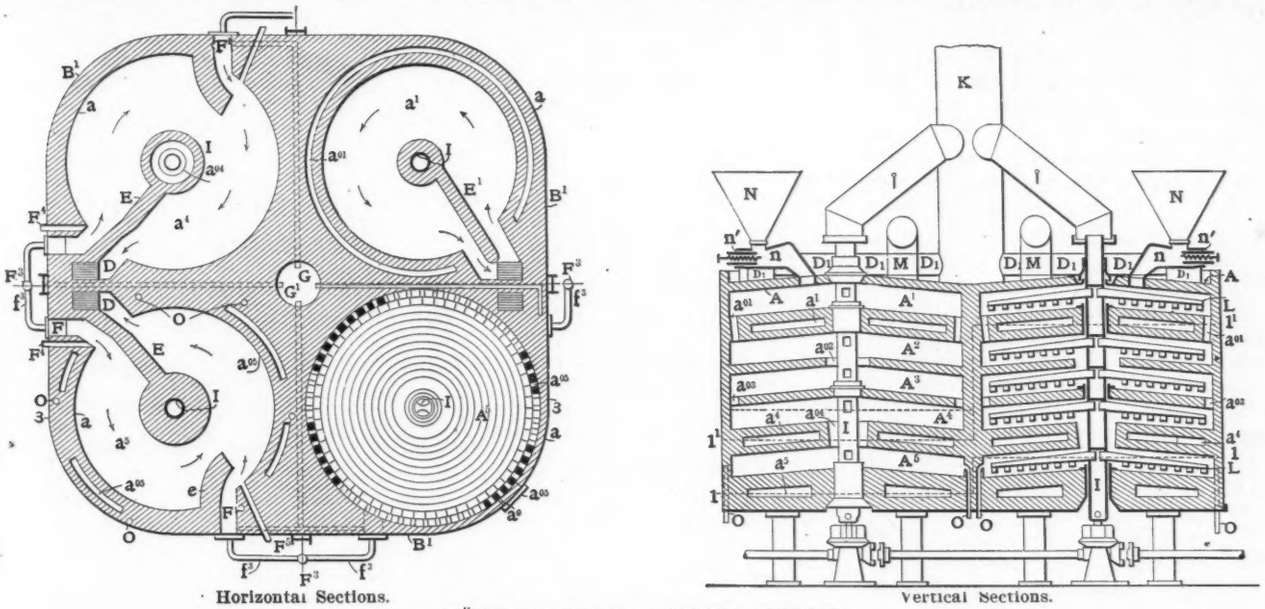
Inquiring into the relative value of the gases thus ordinarily obtained in practice from the two raw materials in question, and taking for illustration a 14 per cent. strong gas, we find that the one made from brimstone will contain about 7 per cent. free oxygen, while that obtained from pyrite contains less than 2 per cent.; and, as an excess of free oxygen is objectionable (tending to form sulphates in the cooking liquor), the advantage of pyrite gas as compared with brimstone gas is obvious.

It is true that when burning pyrite of a walnut size in the old fashioned kilns, the gas usually averaged only 8 per cent. sulphur dioxide, and that such a gas did not prove as economical as one of greater strength. But even with such a weak gas, a satisfactory bi-sulphite liquor can be made, if only the absorption system is of ample dimensions and the absorption water sufficiently cold. Our own experience is that, with a tower system and with Lake Superior cold water, an even 12 to 14 per cent. gas is more advantageous and economical for the production of the desired sulphite liquor than a richer gas. Also that a gas of this strength, made from pyrite in our roasting and gas-cleaning plants, gives better and more economical results than that made from brimstone in our sulphur burners.

The saving of power in driving fans and pumps in connection with a more concentrated gas (which has been enlarged upon) is so insignificant as to hardly be worth considering; and as for aiming at the highest concentration possible in the manufacture of a sulphite liquor, every sulphur maker knows this to be poor practice. In order to obtain the right proportion between free and combined acid in the cooking liquor, it is true, as stated, that a reasonably strong gas is required; but a very concentrated gas is liable to cause sublimation of sulphur, and this sublimation also limits the concentration of the gas. What we want is a liquor with a total of about 3.5 to 4 per cent. sulphur dioxide; and such a strength we obtained, readily and cheaply, from a gas containing 12 to 14 per cent. SO_2.

The possibility of producing a suitable gas equally as well from pyrite as from brimstone now having been shown (and this fact also being well known to the best sulphite pulp makers on this continent who can speak from experience), I will compare the two raw materials as to cost.

Pure pyrite contains 46.67 per cent. iron, and 53.33 per cent. sulphur; and brimstone, about 100 per cent. sulphur. Consequently one ton of pyrite corresponds in sulphur content to 0.533 ton brimstone. However, pure pyrite deposits are not found in nature, the commercial product generally containing from 45 to 50 per cent. sulphur; whereas commercial brimstone, usually, is 98 or 99 per cent. pure. A ton of brimstone, therefore, equals in sulphur value from 2 to 2.2 tons pyrite. At present quotations, pyrite fines with 45 per cent. sulphur at 10c. per unit, would cost $4.50 per long ton; consequently the



Horizontal Sections. Vertical Sections.

SJÖSTEDT-MC DOUGALL ROASTING FURNACE.

* Chief metallurgist, Lake Superior Power Company, Sault Ste. Marie, Ont.

sulphur contents in such material would cost at the rate of $10 per long ton; while the Louisiana brimstone is quoted at $22.25. This is a difference of $12.25 per ton in favor of the pyrite. True, against this we must place a number of sundry expenses, such as the difference in losses, in cost of labor, in power, in water, in cost of plants, in freight charges, etc.; but notwithstanding, this under-rated article can generally bear it all. These items, however, will differ in each particular place, and will thus produce a different balance sheet in each case; and as no general argument, therefore, would here be sufficient or of any real value, a definite instance has to be presented. Our own case may, therefore, be accepted as an illustration:

The brimstone used at Sault Ste. Marie came from a Louisiana mine, from which point the freight rate amounted to $7.87 per gross ton; and at the time referred to brimstone cost us $27.25 per ton f. o. b. here. The pyrite came from the Helen Mine property, Michipicoten (where large pockets of granular ore are found, containing about 47 per cent. sulphur); and the low freight rate from this place, together with the cheap mining, would make it a profitable proposition to deliver it to the roasting plant at $5 per ton (or about 11c. per unit).

During the trials referred to, about 3000 tons of pyrite and 375 tons of brimstone were used, thus affording us an opportunity for obtaining accurate data for comparison. The roasters used for treating the pyrite are of our own modification of the McDougall type[1]. For burning brimstone we used ordinary cast-iron sulphur furnaces.

Omitting all details, it suffices to state that, in our practice, we found that on an average 2.25 tons of our 47 per cent. pyrite equal, in efficiency and in amount of liquor and pulp produced, 1 ton of brimstone. In roasting 22.5 tons of pyrite and burning its equivalent of 10 tons of brimstone per day, our daily expenses were as given herewith:

When Burning.	Pyrite.	Brimstone.
Labor, about	$20.00	$8.00
Steam for drying pyrite	10.00	....
Power, water and light.	5.00	2.00
Repairs and sundries..	9.00	1.00
Depreciation of plant, 10%.....	15.00	1.50
	$59.00	$12.50
Material, 22.5 tons pyrite @ $5.....	112.50	....
Material, 10 tons brimstone @ $27.25.....	....	272.50
Bal'ce in favor of pyrite	113.50	....
	$285.00	$285.00

This means a saving of pyrite at the rate of $11.35 per gross ton sulphur used, which in a 50-ton sulphite mill would alone amount to about $30,000 per annum.

To assert as a general maxim that "American mills would not and could not use pyrite, even if they were in a position to obtain it free of cost," is therefore an exaggeration. In this connection, one of the greatest American sulphur experts wrote us some time ago as follows: "The reason for not using pyrite in other (American) mills is simply the scarcity of pyrite. In Europe we have, in the last two years, introduced 70 pyrite burners in 20 different sulphite mills. Everywhere where pyrite burners can be had at a reasonable price, pyrite burners are installed in place of sulphur burners."

The truth is that each of the materials in question has its legitimate place; and local conditions only can determine which one of them will be the cheaper and to be preferred at any particular mill. It may be true that "the general brimstone situation is secure as far as supply and prices are concerned"; but it is even more certain that any sulphite-pulp mill owner who has a good pyrite deposit not too far from the mill, or who can contract for his pyrite requirements at the usual trade quotations, for even half a dozen years, possesses a valuable asset, and should not delay in replacing his sulphur burners by modern pyrite roasters.

Beside producing a cheap (and in every respect, a suitable) gas, the pyrite also leaves a residue (the "cinders which contain some 50 to 60 per cent. iron, and from 1 to 5 per cent. sulphur), and which, even if it has to be further roasted and briquetted, always has some value, as it can be used, and generally is being used abroad, as a mixture, either in the blast furnace, or in the puddle or open-hearth furnaces.

[1] Canadian Patent, No. 81,495, June, 1903; described in *Journal* of the Canadian Mining Institute, Vol. 7.

Chilean Copper Mines.

At Antofogasta, the Guanaco, once a gold mine, is now being worked for copper, which appeared at depth of 328 ft.; the bottom workings (820 ft.) are still in iron and copper pyrites. Several deep copper mines are being worked in Chile. In the department of Chañaral the Fronton mine has attained a depth of 1,837 ft., the bottom workings still being in good ore. One vein of pyrites, about 6½ ft. in thickness, yields from 7 to 8 per cent. copper; while a second vein, about 2½ ft. thick, yields from 10 to 11 per cent. The Descubridora de Carrizalillo mine, in the same region, has a depth of 2,132 ft. In Los Pazos district two large veins of oxidized ores, varying from 26 to 65 ft. in thickness, are being worked in shallow depths. In the department of Copiapó, La Dulcinea, worked by the Copiapó Mining Company, is the deepest mine and the largest producer in the whole of Chile. The vertical depth amounts to nearly 2,624 ft., while longitudinally it has been worked for 1,640 ft. Copper pyrites was met with at a depth of 656 ft. In the department of Freirina, the Socabón mine has a depth of 1,371 ft. The vein, from 5 to 8 ft. in thickness occurs in a granite rock; the ore, chiefly copper pyrites, averaging about 18 per cent. of metal. In La Serena department the veins of La Higuera district occur in dioritic rock, the gangue consisting of calcite and asbestos, termed *piedrapalo* by the miners. The Brillador and San Antonio mines, to the south of the same department are about 1,800 ft. deep. The famous Tamaya district, in the department of Ovalle, which formerly was the largest copper producer of Chile, is at present worked only on a small scale. The Rosario mine has a depth of about 1,900 ft.

Loss of Heat By Radiation.

J. Bied reports (*Revue de Metallurgie*, September, 1905) experiments to determine the loss of heat from the sides of a flue or furnace. Boxes made of galvanized iron, with a surface of 0.25 sq. m., were pressed closely against the brick-work, and water circulated through them. The losses through refractory material of various kinds and thicknesses, for varying differences of temperature, are given in kilogram-calories per hour per square meter of radiating surface:

Kind of wall. (Thickness in centimeters).	Difference of Temperature.	Loss per hour per sq. m.
14 c.m. alumina brick.....	500° C.	1,600 cal.
	700	2,208 "
5 c.m. magnesium carbonate	700	2,506 "
Ditto—with 20 c.m. small cinders and 3 c.m. of cement....	700	526 "
5 c.m. of lightly compressed infusorial earth.....	650	1,800 "
20 c.m. alumina brick.....	700	2,570 "
Ditto—with 20 c.m. small cinders.	700	900 "
45 c.m. magnesia brick.....	1,300	1,300 "
6 c.m. magnesium carbonate		
80 c.m. ordinary fire-brick..	1,600	1,900 "

The conditions of the test do not correspond to those of free radiation, but the results are, nevertheless, valuable.

Mining at Bendigo.

The output at the Bendigo mines during 1905 amounted to 218,682 oz. For the fifth year in succession the South New Moon ranks as the largest gold producer and dividend payer. The results obtained by the three leading Bendigo companies during the year 1905 are as follows

Company	Tonnage.	Yield.	Dividends.
South New Moon..	28,109	25,339 oz.	£70,400
New Moon.....	29,374	17,931 oz.	45,600
New Argus..	9,686	11,556 oz.	28,500

There are in all 17 dividend-paying companies in the Bendigo district.

The shaft of the New Chum Railway mine at Bendigo is now about 4100 ft. in depth and is being carried down to 4262 ft. before cross-cutting will be started to intersect the lode which has already been met with in a winze. The Victoria Quartz Company has carried its main shaft down to a vertical depth of 4028 ft. There is a winze in this mine which has reached a depth of 4153 ft. These are probably the deepest gold mines in the world.

Fire-Brick Work for Boiler Setting.

BY R. P. KING.*

Fire bricks contract when heated. This should be borne in mind when designing arches and furnace walls, and when locating steel work that expands when heated.

The bricks need not be selected on account of hardness, although they must not soften under 3000 deg. F. Brick for arches must be selected with a view to absolute uniformity of size, contraction and fusing.

Uniformity is most important in a fire brick; a good second, uniform in size, hardness, contraction and fusibility is preferable to a first-quality brick that lacks these qualities.

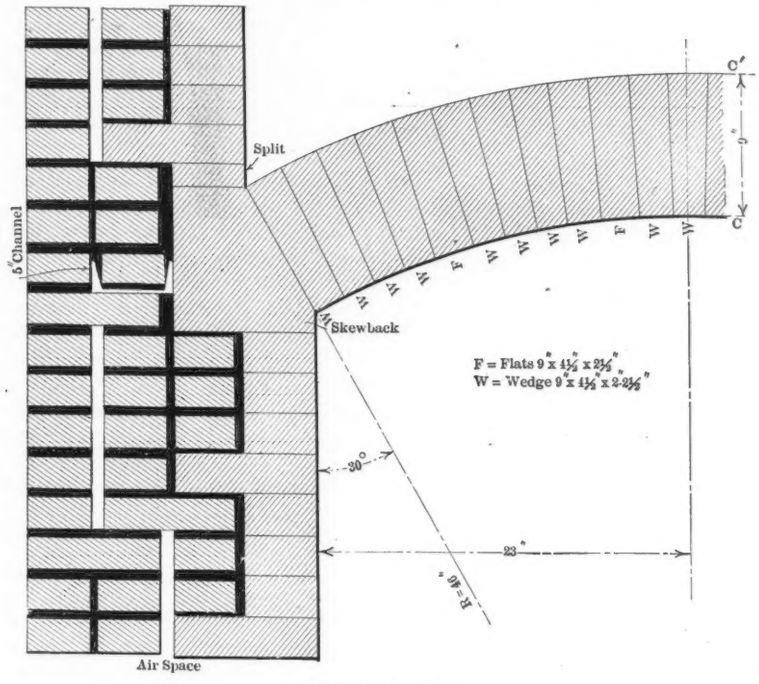
When selecting brick for a boiler setting, the red brick for the backing should be selected with as much care as is given to the fire brick. They should be hard burned, swells and bumps not being objectionable unless the distortion prevents good laying; the appearance is of minor importance. The size of the red brick should conform to the size of the fire brick, so that header courses may be put in regularly as often as necessary; the courses should be so arranged that all headers be laid level.

Many writers say that for good work the clay should be the same as the bricks are made of. I do not believe that this is essential, my experience being that nearly any clay is good, provided it is finely ground. If a glaze is desired, a little common salt mixed with the clay will suffice to produce it.

*Abstract of a paper in *American Machinist*, April 12, 1906, p. 483.

In the illustration is shown a half arch and one arrangement of the skew back and side wall that support it. The skew backs for flat arches require attention, as upon their stability depends the strength of the arch. It is better to use specially molded skew backs, of a form similar to those shown in the illustration. Back of the skew backs, well protected by the masonry, should be placed structural steel of suitable form to carry the thrust of the arch to the buck stays.

Taking the case illustrated, where the angle of the skew back is 30 deg. from the vertical, and the width of the fire box 46 in., one-half the span or 23 in. divided by the sine of 30 deg. = 46 in., from which



A FIRE-BRICK ARCH.

the circumference of the inner circle C equals 289 and of the outer circle C' 345.6 inches.

If wedge brick tapering from 2½ to 2 in. are to be used, making up any deficiency in alinement with 2½-in. flats, then:

Let x = the number of wedge brick.
y = " " " flat "
Then $2\frac{1}{2}\ x + 2\frac{1}{2}\ y = 345.6$
and $2\ x + 2\frac{1}{2}\ y = 289$
from which $x = 113$ (nearly)
$y = 25$ (nearly)

The arch includes 60 deg. and we take $\frac{113}{6}$ for the number of wedge brick and $\frac{25}{6}$ for the flats. The results taken in even numbers give 19 wedge and 4 flats, as shown in the figure. Any problem involving arch, wedge or circular brick may be worked out in the same manner with results sufficiently close for practical purposes.

In estimating fire-brick work, it is not enough to calculate the number required; from 5 to 10 per cent. must be added.

Causes of the Courrieres Explosion.

SPECIAL CORRESPONDENCE.

The Courriéres disaster has led to a discussion at the French Academy regarding the causes of the catastrophe. A letter was read from a German authority in which it is stated that the successive explosions which took place in the galleries were due to the ignition of coal-dust, and that the explosion was mainly due to the absence of sprinkling in the galleries and workings. In the face of this M. Berthelot declared that watering presents serious inconveniences. In Belgian and Westphalian mines this method has developed what is known as ankylostomiasis, which is another word for the disease known as miners' anemia. It has been found that this becomes epidemic in the mines where this procedure is followed. M. Berthelot went on to say that engineers are thus faced with two evils, explosions due to presence of coal-dust, which are rare, or the spread of miners' anemia. These epidemics have forced German mining companies to adopt such strict and stringent hygienic regulations for the miners that Westphalian miners in particular have considered the rigorous methods quite sufficient excuse for several strikes.

M. Zeiller stated that explosions due to coal-dust are really only dangerous to life, speaking broadly, when a minimum quantity of firedamp or gas produced from coal distillation serves to unite the different particles of coal-dust suspended in the air..

M. Michel Lévy did not believe that firedamp was necessary as an hypothesis to explain the accident. To fix coal-dust as one of the chief causes of the disaster, it will be necessary to discover traces of coke deposits on the woodwork and walls of the mine. The inquiry undertaken by one of the most prominent French mining engineers, M. Delafond, will show, concluded M. Lévy, the exact causes and responsibilities attached to the accident.

The Deep Leads of Victoria.

The deep leads of Victoria are old gold-bearing gravels, hidden beneath thick sheets of lava or silt. Their working involves a difficult search and a costly struggle with water. The course of the old river system has to be determined by boring through the lavas that filled the old valleys, and then the gravels have to be pumped dry. This is a long and tedious task. For example, according to the monthly report, the two neighboring mines, the Victoria Deep Leads and the Loddon Valley Goldfields, together pumped in January 250,000,000 gallons. This pumping has to go on for years. A mine may have to pump a million gallons of water a day for years before any gravel can be dug from the mine.

The Quincy Mine Assay Office—III.*

BY C. W. MACDOUGALL.†

WASTE SLAG FROM THE SMELTING WORKS.

Once each month the percentage of copper in the waste slag from all the Quincy mineral smelted by the Quincy smelting works is assayed by the electrolytic method at the mine assay office.

Method of Taking the Waste-Slag-Sample—Once an hour during the entire run on Quincy mineral, a small ladleful of slag is taken by holding the ladle in the stream of molten slag flowing from the slag spout of the settling box. When the ladle is full, and while the slag is still in a molten state, the slag is poured into a bucket of water to granulate it, and also to leave it in such a condition that it may be decomposed by acids. When the run for that shift is finished, the entire sample of waste slag is mixed and a small quantity is taken to the smelting works assay office. Here a portion of the sample is taken for assay by the colorimetric method; the balance is put one side to be sent to the mine assay office. When all the samples for the month have been taken they are sent to the mine assay office.

Treatment of the Slag at the Mine Assay Office—100 grams of each sample is placed in a bottle, the number of which corresponds to the date of the sample, 20 grams from each of the samples are then taken and placed in another bottle. The contents of this last bottle represent a sample from the entire slag discarded during the month. This combined sample is then ground until it will all pass through an 80-mesh sieve. The sample is then ready for the chemical treatment, which is as follows:

Five grams of the ground slag are taken in the same way as that for the waste sands. This 5-gram sample is placed in a No. 3a casserole, moistened with water, and 30 c.c. of concentrated nitric acid is added. When all action ceases the mixture is boiled until all red fumes have disappeared. It is then cooled and 8 c.c. of concentrated sulphuric acid is added. The cover of the casserole is then removed and the solution evaporated until dense fumes of sulphuric oxide gas are given off. This treatment dehydrates the silica so that the solution will filter readily. After cooling the casserole and contents, a little water is added and all lumps broken up. The solution is then filtered through a 12.5 cm. Munktell filter, and the residue washed until no copper is shown in the wash water by the ammonia test. To the filtrate is added 5 c.c. of sulphuric acid, and 1 c.c of nitric acid. The solution is then electrolyzed in the same manner as the waste sands, and the percentage of copper determined by the same formula.

Washing, Drying, and Weighing the Cones—When the electrolytic action is complete, the beaker containing the electrolyzed solution is removed and another beaker containing water is quickly substituted. The cone is then dropped into this beaker by loosening a thumb screw. As soon as possible the cone is removed from this beaker to another containing water. This operation is continued until the cone has been washed in ten changes of water. This process removes all acid and fine sediment that may be adhering to the deposited copper. The current is allowed to flow through the main leads until all the cones have been removed and washed. After washing, the cone is placed in a beaker of absolute alcohol to remove as much of the adhering moisture as possible. The cone, wet with alcohol, is then held over the flame of an alcohol lamp until the adhering alcohol is ignited; the cone is then moved through the air until the alcohol has burned off. This movement keeps the cone fairly cool and prevents oxidation of the copper coat. Finally the cone is held directly over the flame from the lamp until the last traces of moisture have been removed and the cone is absolutely dry. The cone with the copper coating is then weighed on a Becker balance, the weight being determined to one-tenth of a milligram. After the weight of the cone and copper has been found, the weight of the cone as previously found is deducted, and the weight of the copper deposited is determined. By substituting the weight found, in the various formalas, the percentage of copper in the respective sample may be calculated.

After the weight of the cone and copper has been noted the cone is placed in diluted nitric acid (one part of water to three parts conc. nitric acid) and the copper dissolved. After this, the cone is washed in a strong stream of water. As the water used in this operation contains a considerable amount of salts, the cone is again washed in five changes of pure water. It is then placed in alcohol and finally dried in the manner described, except that the cone is heated to a much higher temperature than before to oxidize any copper that may not have been removed. This condition is shown by the appearance of black spots of copper oxide on the cone, in which case the cone is placed in the nitric acid again and washed as before. When the cone is clean and dry, it is cooled, weighed, and the weight noted. This weight is used in the determination of the weight of the copper coating in the next assay.

METHODS OF KEEPING THE ASSAY RECORDS.

Each bottle that contains a sample has received a number known as the "bottle number," and each assay made receives a number known as the "assay number." The source of the sample (that is the machine or launder from which the sample has been taken) has also received a number, or a number and a letter, that will indicate the source. Since there are eight heads in the two mills, in the case of the machine samples which have both a number and a letter, the number corresponds to the number of the head, while the letter represents the class of machine from which the sample has been taken.

All the roughing jigs are represented by the letter *R*. All the finisher jigs by the letter *J*, and the finisher table by the letter *T*. As there are samples received from the same source for both day and night shifts, the second digit of the assay number has been used to represent

TABLE 3.

June 1905. Date of Sample.	Main Launder. Day Samples. Bottle No.	Assay No.	% Cu.	Main Launder. Night Samples. Bottle No.	Assay No.	% Cu.	June 1905. Date of Sample.	No. 2 Finisher Jigs. Day Samples. Bottle No.	Assay No.	% Cu.	Night Samples. Bottle No.	Assay No.	% Cu.
1							1						
2	5	1	....	78	6	....	2						
3							3						
5							5						
6	16	11	....	11	16	....	6	108	2 J	.. .	115	12 J	....
7							7						
8	30	21	....	164	26	....	8						
9							9						
10	33	31	....	170	36	....	10						
12							12						
13	109	41	....	2	46	. ..	13						
14							14						
15	5	51	....	78	56	....	15	12	22 J	....	48	32 J	....
16							16						
17	16	61	....	11	66	....	17						
19							19						
20	30	71	....	164	76	....	20						
21							21						
22	33	81	....	170	86	....	22	108	42 J	....	115	52 J	....
23							23						
24	109	91	....	2	96	....	24						
26							26						
27	5	101	....	78	106	....	27						
28							Head Shut Down.						
29	16	111	....	11	116	....	Head Started Night.	12	62 J	....	48	72 J	....
30							29						
Av.			....			....	30						
							Av.			....			....

*Continued from the JOURNAL, April 14, 1906; p. 708.

†Assistant mining engineer, Quincy mine, Hancock, Mich.

the shift. The even numbers, that is, 0, 2, 4, etc., show that the sample has been taken during the day shift, while the night shift samples are represented by the odd numbers, or 1, 3, 5, etc.

Example—(See Table 33). Suppose that the assay number of a sample is No. 22*J*. That shows that the sample assayed was a combination of samples received from the finisher jigs of head No. 2, and was taken during the day shift. If the assay number had been No. 52*J*, it would show that the sample was from the same source as No. 22*J*, but taken during the night shift. The bracket in front of the dates of the samples show the date of the samples that have been combined and go to make up a run.

In the case of the launders, the day shift sample, from the main launder Mill No. 1 is known as No. 1, while the night shift sample is known as No. 6. Thus, samples from main launder Mill No. 2 are known as No. 2 and No. 7; those from No. 6 separate head, as No. 3 and No. 8; those from No. 7, separate head, as No. 4 and No. 9; and those from No. 8 separate head, as No. 5 and No. 1. The number of the run is represented by the second digit (Table 3).

Concentrates—Sample Record—Table 4 shows fully the method used in keeping the results obtained from the assays of the concentrate and also the method of combination.

Waste Slag Sample Record—Herewith is given a copy of a page from the report book in which the record of the waste slag has been kept:

TABLE 2. RECORD OF WASTE—SLAG SAMPLES

Date of Sample.	Bottle No.	Assay No.	% Cu
Sept. 1, 1905.			
1-2 shifts	136		
7	137		
8-2 "	138		
18-2 "	139	500	.....
19-2 "	140	149	
20-2 "	141		
21-2 "	142		
22	143		

Assay Report forms are also given herewith, the small dots showing the positions of the assay percentages.

ASSAY REPORT (FOR MONTH AND YEAR).

Assays of samples received from mills and smelter (for month and year) gave the following average percentage of copper:

	Mill No. 1.	Mill No. 2.	Both Mills.
Hydraulic No. 2 assay percentages	....	....	
Jigs No. 2 assay percentages	....	....	
Average per cent. of copper, from dry weights, No. 2 mineral	....	....	.....
[a]Average per cent. of copper, from wet weights, No. 2 mineral	....	....	.....
No 3 mineral assay per cent., and per cent. of copper from dry weights	....	....	.....
[a]Average per cent. of copper, from wet weights, No. 3 mineral	....	....	.....

[a]Per cent. of moisture.
No. 2 Hydraulic .... %.
No. 2 Jigs .... %.
No. 3 Mineral .... %.

Waste Sands.	Day Samples. Mill No. 1.	Day Samples. Mill No. 2.	Night Samples. Mill No. 1.	Night Samples. Mill No. 2.
	%	%	%	%
From Entire Mill..... %	....	....	....	....
" No. 6 Launder				
" No. 7 "		....		
" No. 8 "				
" No. 6 "				
" No. 7 "				....
" No. 8 "				
No. 1 Roughing Jigs.....	....		....	
" 2 " "	....		....	
" 3 " "	....		....	
" 4 " "	....		....	
" 5 " "	....		....	
" 6 " "		....		....
" 7 " "		....		....
" 8 " "		....		....
No. 1 Finisher Jigs.....	....		....	
" 2 " "	....		....	
" 3 " "	....		....	
" 4 " "	....		....	
" 5 " "	....		....	
" 6 " "		....		....
" 7 " "		....		....
" 8 " "		....		....
No. 1 Finisher Tables....	....		....	
" 2 " "	....		....	
" 3 " "	....		....	
" 4 " "	....		....	
" 5 " "	....		....	
" 6 " "		....		....
" 7 " "		....		....
" 8 " "		....		....
Waste Slag from Smelting Works...		....		

Hints on Structural Work.

BY J. H. GRANBERY.

In steel-work construction for metallurgical plants it is well to remember that a "limit size" of material can be reached when further lightening by a decrease of size will increase the expense by the added labor required in fabricating the material. For this reason it is sometimes specified that no sections shall be used which will not permit of the employment of ¾-in. rivets throughout. This is according to the best practice of large structural steel makers. For very light work, however, ⅝-in. rivets are often employed; and for this class of work angles 1½ x 1½ x 3/16 in. are sometimes used. This size, however, should be regarded as the extreme, and should not, usually, be used for members carrying sufficient load to permit of calculation. The "irreducible minimum" should, in ordinary cases, be fixed at ¾-in. rivets and 2½ x 2½ x ¼ in. angles. Anything of smaller size than this is extremely difficult to handle on account of its liability to bending or breaking during shipment. It is also a matter of great manual dexterity to cut out and replace rivets in such light material without cracking the sections themselves.

Where channel columns are used, it is the best plan, so far as economy of material is concerned, to place them face to face, and not back to back as is often done. Riveters are now made which drive rivets on either side of the flange, whether the column be turned flanges in or out; with equal facility. This has brought about the adoption of machines of this type by practically all first-class makers. It is needless to say that light structural material especially should not be entrusted to other than these manufacturers. Drawings for this class of work should be as full and complete as it is possible to make them, aside, of course, from the fact that general drawings are intended, and not working drawings. These latter the shop can do to better advantage than the engineer who has charge of the metallurgical construction.

In adopting a standard type of mill building for use about metallurgical plants, the steel skeleton with corrugated-sheet covering for both sides and roof, seems to fill the majority of requirements, and it is important, a fact not perhaps often or generally enough recognized, that this type of building requires wind-bracing. There being no curtain walls to take up the strain, disastrous failures have often occurred, due simply to the presence of a slightly higher wind than that contemplated at the time erection was begun. The wind-bracing is perhaps of more importance when the building is in process of erection than when it is completed, as a structure may often have one end sided and the rest of the same work may be loosely bolted together and not adapted to take up the strain. In this case, wind-bracing often prevents a ruined structure.

Determination of Oxygen in Copper.

It has been stated that to expel the whole of the oxygen by heating copper to redness in hydrogen, it is essential to have the metal in a very fine state of division. L. Archbutt finds (*Analyst*, 1905, XXX, 385-394) that the thickness of the copper has little, if any, influence upon the accuracy of the method, but that it chiefly affects the time required for a determination. In the case of copper containing an unusally high percentage of oxygen (over 0.2 per cent.), the turnings yielded 0.224 to 0.226 per cent., while a cylinder 3-8 in. in diameter gave 0.21 per cent. after being heated for eight hours.

A New Dynamite for Collieries.

C. E. Bichel claims (French Pat. 356,-845, July 10, 1905) that a dynamite which has a low velocity of detonation, is easy to use, and gives off inoffensive products of combustion, may be prepared as follows: An intimate mixture (about 80 parts) is made of ammonium nitrate, potassium perchlorate, and sodium chloride, the proportions of each being subject to variation at will. To this there are added 6 to 10 parts of trinitrotoluene dissolved in 4 to 10 parts of nitroglycerin or dinitroglycerin, and finally a small quantity of starch, powdered wood, or flour in order to facilitate the absorption of the nitroglycerin. The resulting explosive is stated to be easy of manipulation, and insensitive to shock, and very suitable for use in presence of fire-damp.

Grading Pig Iron.

BY REGINALD MEEKS.

The commercial value of pig iron depends, primarily, upon the use for which it is intended; and this, in turn, is determined by the existing proportions of the impurities or metalloids.

In designating the classes or grades of iron, two general methods are followed. Each has its adherents; and, in the conflict of opinion, much confusion arises. The older and time-honored custom of selling iron by grades, determined by inspecting fresh fracture of broken pigs is slowly but surely giving way to the more accurate method of classification by chemical analysis and disregarding the appearance of the fractures.

Were all conditions in the manufacture of pig iron uniform from day to day, there would be sufficient reason for continuing the grading by fracture; but, as ore mixtures, furnace operation, temperature, rate of cooling, and methods of casting, are all more or less variable, it is impossible to expect uniformity of grain in the pig irons of today. With the many brands, classes and grades of pig iron confronting the purchaser, it is a matter of great difficulty to select the proper irons for his particular need. But with the analysis of each car of iron before him, he can, almost at a glance, select the cars he requires.

The various classes of iron may be designated as northern, southern, basic, bessemer, forge, foundry, charcoal and ferro-silicon. Each of these may be subdivided into one or more sub-grades, and even into six or seven, as in the case of foundry pig.

As more light is thrown upon iron mixing, these various grades are being superseded by specifications calling for definite chemical composition (within reasonable limits), and fracture-grading is not holding its former prominent position.

Pig molding by machine is gaining favor rapidly; no one would attempt to use this class of iron by relying on fracture-grading, inasmuch as certain low-silicon or "chilling" irons are clear white, while all are much denser than sand-molded pig. Yet machine-cast pig gives perfect satisfaction when properly mixed.

The general characteristics of the classes of iron are varied. Northern pig is made of ores largely from the Lake Superior region, and is, by nature, lower in phosphorus and higher in manganese than pig made from ores of the South. The former is known as "strong" iron, while the latter as "weak" and "fluid" In both classes of iron, the silicon and sulphur may be the same. Among northern irons are found bessemer, forge, foundry and charcoal brands. Southern iron finds its field in stove and other light work, in the basic open-hearth process, and in mixing with the stronger more sluggish northern iron in the foundry.

There is a considerable difference in price at the furnace between the two, but this is cut down largely by freight charges; so that, delivered to a given point, the saving may not warrant the use of the weaker iron if strong castings are desirable. As a general rule, most founders use some of each iron in their furnaces.

The fault in southern irons lies principally in the high phosphorus. They rarely contain less than 0.8 and frequently run higher than 1.5 per cent.

In certain sections of the country (notably Virginia) the ore contains a high percentage of manganese, and the resulting pig iron is known as basic. Where high manganese is desired in the product, these irons find a ready market. By their use, less ferro-manganese is required, and a more uniform manganese content is obtained. With ferro-manganese quoted at three figures per ton, this is a substantial saving.

Bessemer iron is used almost exclusively by steel makers using the acid bessemer converter; and producers of low-phosphorus castings are content to purchase what is termed "off" bessemer iron. True bessemer iron contains less than 0.1 per cent. phosphorus, because blowing into steel will not remove any of this impurity, and its presence in steel in amounts greater than the above, renders the finished product "cold short" and unsafe. "Off" bessemer, as the name implies, consists of iron approximating the true, but unfit for steel making. There are no rigid limits set, however, and this iron is popular with car-wheel and malleable-iron manufacturers.

"Forge" iron (or as it is familiarly known, "gray forge") is used largely in rolling mills, although wheel makers are large consumers as well. It may be a high- or low-phosphorus iron, but in any case the amount is larger than in bessemer iron, and silicon is often as high as 1.5 per cent. In the puddling proces silicon, phosphorus and sulphur are decreased.

Probably the purest of all pig iron is charcoal iron. This is made in small furnaces, using charcoal for fuel and operating with cold blast. The production per furnace is much smaller than with a coke-iron furnace, and the fuel is more expensive; hence the selling price per ton is several dollars higher than for coke iron. Were it not for the sale of the by-product, wood-alcohol, it is doubtful whether charcoal iron could compete with coke pig. In earlier times it was believed that car wheels and malleable iron could not be produced except with the exclusive use of charcoal iron; those were the palmy days for this class of pig. Since then it has been demonstrated that both of these manufactures could be made and marketed, using no charcoal iron in the mixture. The demand for this iron has necessarily fallen off, although many manufacturers still continue its use where strong special castings are desired.

In bygone days a furnace, when "going bad," produced what was known as "burnt iron." No founder would use or purchase it, and it was considered a total loss. Later it was discovered that this was simply highly siliconized iron, and that it is of great value as a softener. The name "ferro-silicon" was given it, and recently it has commanded a premium. There are several furnaces today producing ferro-silicon exclusively, and nearly every stack makes it occasionally. The silicon contents range from 6 to 12 per cent., and the electric furnace produces a still higher grade running 50 to 75 per cent., or even higher.

But it is among foundry irons that there exists the greatest variation in grades. Here are found "Scotch" or No. 1X, No. 1, No. 2X, No. 2, No. 3, etc., in most of the numerous brands on the market.

A furnace charging a similar class of ore will usually produce iron carrying nearly uniform phosphorus and manganese, but silicon and sulphur vary considerably. These latter elements have a marked tendency to change the appearance of the fracture; and, were it not for furnace conditions and temperature, the metalloids could be quite accurately approximated. But under existing conditions, the individual judgment of fracture is very much in error. And so chemical specifications have, to a great extent, superseded grading by fracture. The following is taken from the *Transactions* American Institute of Mining Engineers, Vol. XXXV. p 18?·

"In the absence of specifications, the current grades of pig iron should be considered as representing the following chemical composition:

Grade.	Silicon. Per cent.	Sulphur. Per cent.
Scotch	Over 3.00	Not over 0.030
No. 1	2.50 to 3.00	" " 0.030
No. 2 X	2.00 to 2.50	" " 0.045
No. 2	1.75 to 2.25	" " 0.055
No. 3	1.50 and over.	" " 0.075

"The modified report omits the grades kown as Scotch and No. 2, and substitutes the following classification:

Grade.	Silicon. Per cent.	Sulphur. Per cent.
No. 1	2.75	0.035
No. 2	2.25	0.045
No. 3	1.75	0.055
No. 4	1.25	0.065

There is a permissible variation of 0.01 per cent. of sulphur, and 10 per cent. of the quantity of silicon."

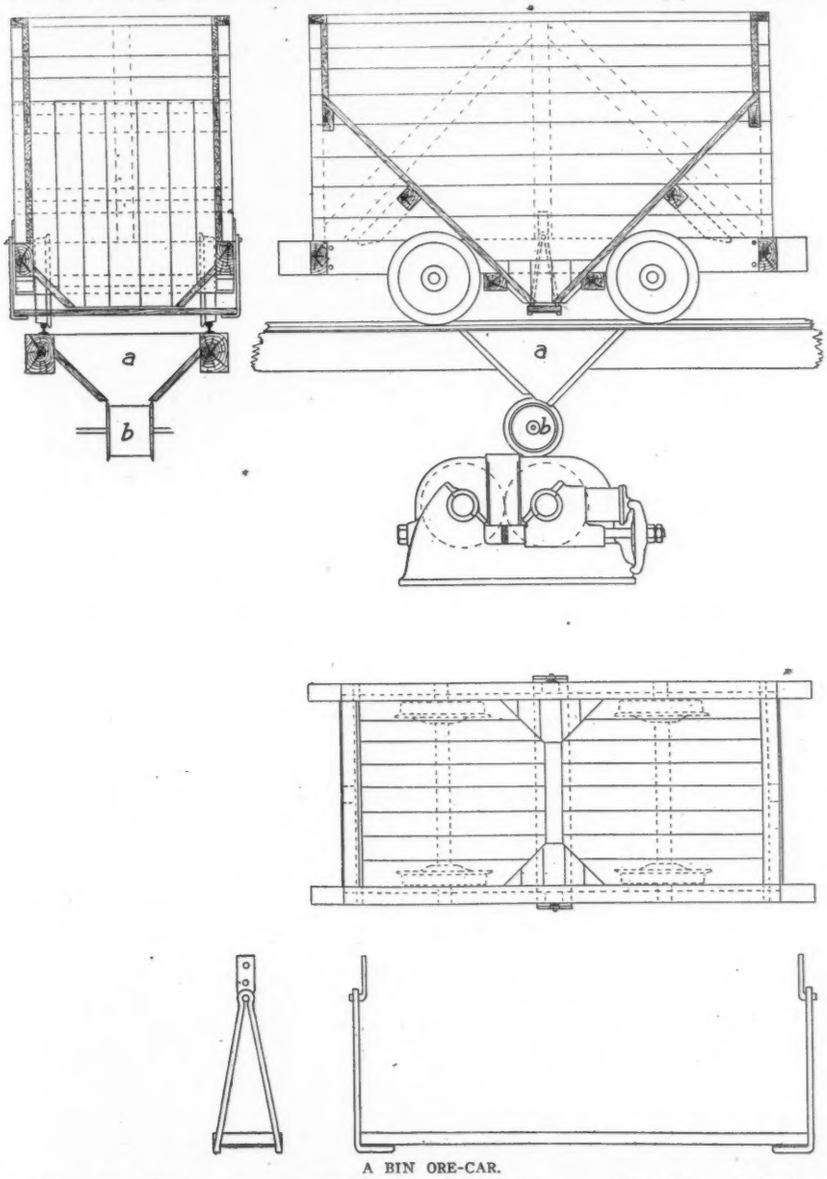
Naturally fracture does not enter into the consideration of iron purchased under such specifications.

Finally it should be remembered that perfect castings can be and are made every day from pig iron that is not seen by the man who makes the mixtures, and who simply mixes according to the analyses of the various brands of iron at his disposal.

A Bin Car.

BY R. D. O. JOHNSON.*

The mine and the mill of the Central Lead Company in the southeastern Missouri lead district, are about a quarter of a mile apart. The ore is crushed at the mine. The relation in level between the discharge chute of the crushers at the mine and the feed hopper at the mill is such that storage bins cannot be used without the adoption of some hoisting device. This latter was undesirable.



A BIN ORE-CAR.

The car shown in the illustration combines the utilities of storage bin and vehicles for transportation. The capacity is 200 cu.ft. or over 20,000 lb. of ore. Fourteen of these in constant service are equivalent to a bin capacity of 140 tons. The relation between the demand of the mill and the supply of the mine is measurable by the number of cars standing at either end of the line.

The cars were drawn singly, by a team, over a level track. Switching and placing at each end was done by the same team. Though the construction may appear to be rather flimsy for the capacity, the level track and the manner of handling justified the design. Repairs were rarely necessary and were generally confined to the bottom door, the hinges of which were occasionally broken by the car getting off the track when coming from the mill empty.

The door consists simply of a 2x12-in. oak plank supported at the ends by hangers, which, in turn, depend from an "ear" bolted to the sides of the car. When the car was filled, the door was generally secured in position by a pin placed between the legs of one hanger into a hole bored in one of the car sills. Neglect of this precaution occasionally resulted in the door being knocked open by striking some obstruction on the track. When this happened, with the progress of the car, the contents would be spread out on the track in a long and uniformly thick ribbon of ore. Such happenings being chargeable to the carelessness of the driver, it devolved upon him to shovel the ore back into the car. A few lessons of this kind rendered the most obtuse driver cautious about seeing that the door was properly pinned before the start for the mill.

At the mill the car was placed as shown over the small feed hopper *a*. The bottom door is pried back with a lever and pinned and the feed roller *b* feeds the ore from the car to the rolls. The hopper has sufficient capacity to maintain the feed during the period necessary to replace an empty car with a full one.

The cars were not lined except with scrap 1-in. plank at points subjected to the most wear.

*Mining and mechanical eng'r, Denver, Colo.

Gold in Madagascar.

According to U. S. Consular reports, the alluvial gold deposits receive most attention in this locality. Some of these enterprises have become permanent and profitable, and the industry promises to become a valuable one. Claims are laid out to have a circumference not exceeding that of a circle of one kilometer radius. A signal post is planted in the center of the claim, bearing a sign-board in French, giving the names of the prospectors, the character and nature of the deposits, and the date of planting. The claimant afterward submits a plan, drawn to a scale of 0.0001, to the district mining commissioner, and accompanies it with the sum of $4.82 as a tax for the license required by law. About this concession the prospector has the privilege of creating a native village and may engage natives to pan out the gold in the wooden dishes used, the natives making their returns according to agreement. Payment for this service is made at the rate of about 19c. per gram, and the product is disposed of to the banks after the payment of the tax of 5 per cent. to the Government. It is not at present possible to operate mining concessions in any other manner; Caucasian races cannot do the work personally on account of the unhealthy climate. Sluice boxes have been installed, but without success, and the amount of capital required for work in this district is great enough to render the returns problematical.

Coal Production of Russia.

The coal output of Russia in 1905 is estimated as follows, in metric tons:

Donetz basin	12,979,512
Dombrova	3,603,600
Moscow	230,958
Caucasus	32,760
Other districts	655,200
Total	17,502,030

This is a decrease of 1,381,152 tons, or 7.4 per cent., from 1904. The heaviest decrease was in the Dombrova district.

Tin Mining in Bolivia.*

BY JOHN D. MINCHIN.

The tin mines of Bolivia are scattered through the mountain ranges bordering on the eastern side of the Andean tableland, and extend about 300 miles from north to south. The general geological formation is a metamorphic shale, evidence of igneous action being invariably visible in the immediate neigborhood of the deposits.

Probably 95 per cent. of the tin production of the country is from lode mining, only a small amount of stream tin being collected. The importance of the deposits is variable, everything from thin stringers to lodes of 5 or 6 m. width is met. The cassiterite presents itself as solid masses, nodules, and grains, usually in a ferruginous matrix, not unfrequently with iron pyrites and rarely with wolfram.

Ores running as high as 40 per cent. and 50 per cent. of tin are not uncommon, and under favorable conditions as low as 3 per cent. may be worked at a small profit; but the average tin content of ores worked by the larger mines may be estimated at 8 to 10 per cent. Ores worked for silver also frequently contain from 2 to 5 per cent. of tin oxide, which in such cases is cheaply extracted from the tailings.

The treatment of nearly all the ores in the country is limited to ordinary dressing, the product being exported in the form of *barrilla*, containing on an average 64 per cent. of metallic tin. In the Potosi district, owing to higher freights, a quantity of low grade concentrates are reduced in small water jacket furnaces with charcoal and run into bars.

For reducing the ores, crushers, stamps, and ball and Huntingdon mills are employed, and occasionally rolls, while the concentration is affected on Wilfley, and other tables, and in Cornish round buddles and revolving tables, the old rectangular hand buddles with a broom being still to some extent also employed.

Unfortunately, there is little or no water power available on the Bolivian tableland; consequently steam power is usually employed, llama dung and other native fuels being used; these, however, are of poor quality, and are becoming scarce in many districts, while imported coal costs $39 per ton.

Of late years several anthracite producer-gas engines from the "Deütz" works in Germany have been introduced with satisfactory results as regards economy, the working cost being about 4c. per horse-power hour.

The total production of Bolivia during 1905, reduced to bar tin, may be estimated at 13,000 tons of 2,240 lb. I am able to give the exact production in fine tin of the following enterprises—viz.: Compania Minera Huanuni, 1,192 tons; Compania Minera Unica, 485 tons; Abelli y Ca. Avicaya, 722 tons. Among the important enterprises are the following: Chorolque (F. A. Aramayo), Llallagua (Pastor Saiur), La Salvadora (S. Y. Patiño), Penny & Duncan—Huanuni.

*London *Mining Journal*, March 17, 1906.

German Mineral and Metal Production.

The statistics of mining and metallurgical production in Germany and Luxemburg for the past two years as prepared by the Imperial Statistical Bureau, are given in the following series of tables:

The detailed figures of pig-iron production, compiled by the Iron and Steel Union, have already been published (in our issue of Feb. 24, p. 404) and need not be repeated. The figures are in metric tons, unless otherwise noted:

Coal, Petroleum, Etc.

	1904.	1905.	Changes.
Bituminous coal	120,815,503	121,298,167	I. 482,664
Lignite	48,635,080	52,498,507	I. 3,863,427
Graphite	3,784	4,921	I. 1,137
Asphalt	91,736	103,006	I. 11,270
Petroleum	89,620	78,869	D. 10,751

The salts, whose output is shown in the following table, are those that are obtained as natural product, by mining: The potash salts form the basis for artificial fertilizers.

Mineral Salts.

	1904.	1905.	Changes.
Rock salt	1,079,868	1,165,473	I. 85,605
Kainit	1,905,893	2,317,829	I. 411,936
Other potash salts	2,179,471	2,725,654	I. 546,183
Kieserite, glauber salt, etc	695	706	I. 11
Borax	135	183	I. 48

The salts of the following group, on the other hand, were obtained by the evaporation of sea water, or saline spring waters, or brine, and are used principally in the chemical manufacturing arts. The figures for potassium chloride, alum and aluminum sulphate are subject to revision.

Evaporated Salts.

	1904.	1905.	Changes.
Common salt	621,786	612,062	D. 9,724
Potassium chloride	294,802	370,914	I. 76,112
Glauber salt	75,170	68,454	D. 6,716
Potassium sulphate	43,959	47,994	I. 4,035
Potassium-magnesium sulphate	29,285	34,032	I. 4,747
Magnesium sulphate	39,412	58,758	I. 19,346
Aluminum sulphate	52,880	52,892	I. 12
Alum	3,743	4,127	I. 384

The remaining group of salts includes those recovered, mainly, as by-products of the metallurgical industries.

Metallurgical Salts.

	1904.	1905.	Changes.
Arsenic salts	2,829	2,535	D. 294
Copperas	13,433	12,949	D. 484
Copper sulphate	6,584	6,988	I. 404
Copper-iron sulphate	152	159	I. 7
Zinc sulphate	6,185	5,896	D. 289
Nickel sulphate	207	220	I. 13
Tin chloride	866	811	D. 55

The outputs of the metallic ores for the two years are compared in the following table. About half the iron ore is mined in Alsace-Lorraine; Silesia supplies most of the zinc ore; and Mansfeld, in the Halle mining district, furnishes nearly all the copper ore.

Metallic Ores.

	1904.	1905.	Changes.
Iron ore	22,047,393	23,444,073	I. 1,396,680
Zinc ore	715,728	731,281	I. 15,553
Lead ore	164,440	152,725	D. 11,715
Copper ore	798,214	793,488	D. 4,726
Silver & gold ore	10,405	9,628	D. 777
Tin ore	99	123	I. 24
Cobalt, nickel & bismuth ore	14,016	10,848	D. 3,168
Uranium & tungsten ore	23	26	I. 3
Manganese ore	52,886	51,463	D. 1,423
Arsenic ore	4,390	4,887	I. 497
Pyrites	174,782	185,384	I. 10,602
Alum ore	770	620	D. 150
Mineral paints	3,953	3,909	D. 44

The final table compares the total production of the metals and other metallurgical products for the two years.

Metallurgical Products.

	1904.	1905.	Changes.
Pig iron	10,058,273	10,875,061	I. 816,788
Spelter	193,058	198,208	I. 5,150
Lead	137,580	152,590	I. 15 010
Litharge	4,332	3,786	D. 546
Copper	30,264	31,717	I. 1,453
Black copper & slag	641	1,635	I. 994
Silver, fine (Kg)	389,827	399,775	I. 9,948
Gold, fine (Kg)	2,738	3,933	I. 1,195
Nickel, bismuth, etc., preparations	3,063	3,317	I. 254
Cadmium (Kg)	25,245	24,568	D. 677
Quicksilver and antimony	2,777	2,798	I. 21
Tin	4,216	5,233	I. 1,017
Sulphur	209	205	D. 4
Sulphuric acid	1,107,403	1,173,680	I. 66,277
Fuming sulphuric acid	93 084	98.331	I. 5 247

It must be borne in mind that the above includes the total output of the German metallurgical works, and not merely that produced from German ores. Large amounts of lead, tin, gold and silver ores are imported and their metallic yield is not separately enumerated.

Map of the Southwest Nevada Desert.

Surveys were made last summer by R. H. Chapman and B. D. Stewart of the U. S. Geological Survey for a topographic map of the Nevada desert region. The map is now in the hands of the engravers.

The area includes Goldfield and Bullfrog and the territory that lies between them. The map shows also the location of the Chloride Cliff and Keane Wonder properties, the district about Lee's Camp, the Grapevine Range and the Oak Springs region, and a portion of Death valley.

One important feature of the map is the location of springs and water-holes, with the roads and trails that connect them.

The map will be printed on a scale of approximately 1 in. to four miles, with a contour interval of 100 ft. An endeavor will be made to have this map engraved and ready for distribution in the late spring. A report on the geology of this area will soon follow.

The total number of Chinese on the Rand on February 28 was 49,995. The total on January 31 was 47,118. During February, 1,943 coolies arrived, 80 died, 585 were discharged for repatriation, and 28 were returned to China from the coast.

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*Illustrated.

Horace F. Brown.

Horace F. Brown, of whom an obituary notice is printed elsewhere in this issue, was one of the pioneer metallurgists of America. To him belongs the credit of designing the first thoroughly successful straight-line roasting furnace. Other inventors, who succeeded in overcoming the previous difficulties at about the same time, may have had original conceptions, but certainly they were anticipated by Brown. The priority of invention became the subject of a great metallurgical litigation, in which the Brown patents were finally sustained, but the fruits of victory were largely lost by an ingenious evasion, which took advantage of a loophole in the claims of Brown's original patent.

Delays in Government Reports.

It is to be hoped that the reorganization of matters in the Government printing office will result in the devising of means to insure the prompter issuance of many publications. We have especially in mind some publications of the Geological Survey which frequently are greatly belated in the printing office. A little while ago we referred to the tardiness in the publication of the important report by Mr. Spurr on the Tonopah district, which was a long time in press, and this was especially unfortunate because the newness of the district and the great current interest in it demanded timeliness in the report. Unintentionally we fear that we may have conveyed a wrong impression to our readers, in leading them to believe that the Geological Survey itself was slow in giving attention to the Tonopah district. This was neither our intention nor was it the case. Both the Geological Survey and Mr. Spurr have a record with respect to this report of which they may well be proud.

The Joplin District and the Coal Strike.

The comparatively insignificant result which the coal strike in southeastern Kansas has had upon zinc mining in the Joplin district is effective evidence of the change in operating conditions recently established in the latter region. Formerly, a strike of the Kansas coal miners had an important bearing upon the zinc industry, both upon the mining and the smelting sides. The records of the industry are prolific in reports of coal strikes, shut-downs, and consequent shortage of spelter.

The smelters emancipated themselves from this danger, when they abandoned coal fuel and transferred their operations to the gas field. Recently, the Joplin district also was freed from sole reliance upon coal, by the introduction of natural gas by pipe-line from Kansas, and by hydraulic power, electrically transmitted, also from Kansas. The general adoption of these new sources of power enables mining to go on in the district without serious interference by the shortage of coal, only a comparatively small number of the producers, and those mostly the smaller ones, being dependent upon that fuel alone.

The California Earthquake.

The catastrophe in California is still too new, and too colossal in its extent, to permit any summing up that is much worth while. Attention is properly directed, first toward the relief of the sufferers and next to the restoration of business so far as possible, and as quickly as possible. The entire country has responded loyally and promptly to the needs of their fellow citizens in California, and Americans may rightly feel a pride in the generosity of the Nation and the highly competent manner in which affairs at San Francisco have been handled since the disaster.

The cause of the earthquake is naturally a subject of discussion. Everyone knows that it was due primarily to a slip in the crust of the earth, but as to the precise origin of the forces which cause these earth movements there is considerable difference of opinion. The happening of the San Francisco earthquake so soon after the eruption of Vesuvius has given rise to the idea that there may have been some connection between the two, but this is highly improbable. Volcanic eruptions are of comparatively local action. However, it appears that the crust of the earth has recently been in a critical condition, and while Vesuvius did not cause the San Francisco earthquake, it is not impossible that the same factor which released the steam and lava there may have caused the movement in the crust of the earth in California.

There have recently been reports of earthquakes in various parts of the world, and during the last six months there has

been a series of extraordinarily disastrous colliery explosions, which are now firmly believed to be influenced by atmospheric and terrestrial conditions which favor the release of gas in large quantities from coal seams. We called attention to this, in our issue of April 14, in referring to the many explosions in coal mines which occurred in West Virginia last year, and the four serious explosions which occurred in that State during the first three months of the present year. Bearing upon this subject, it is interesting to repeat a portion of a letter from a well-known colliery engineer, who has given great attention to colliery explosions, which was mailed to us under date of April 12. He wrote as follows:

"It is a subject in which I am deeply interested. A letter from Japan states that another great explosion occurred at Nagasaki, March 28, killing 250 men. This and the terrible Pas-de-Calais affair, March 10, are closely connected with the earthquakes in Colombia, February 21; in Formosa, March 17; and the eruption of Vesuvius, April 2. The present period of disturbance is of even greater violence than that which was marked by the eruption of Mont Pelée, May 20, 1902, which was accompanied by the terrible explosion at Fraterville, Tenn., May 19, in which 184 persons lost their lives, and the explosion at Fernie, B. C., May 23, in which 127 lives were lost. These were followed by the disaster at the Rolling Mill mine, July 10, costing 112 lives, and the Mt. Kembla explosion at Sydney, N. S. W., August 1, all of these disasters being in 1902."

This letter was written in commendation of our editorial, in which we emphasized the necessity for the greatest vigilance on the part of those who are responsible for the safety of men engaged in coal mining, especially at the present time. Our correspondent added "Many lives of our miners may be saved by drawing attention to the present condition; and I hope you will do all in your power to induce the needed caution in mines at this time."

Equally prophetic was the statement of the director of the Berlin Observatory, also printed in our issue of April 14, to the effect that the Courrières disaster was connected with atmospheric conditions, and that the crust of the earth is in a dangerous condition at the present time. He predicted other disasters. Although no one could have foretold the disaster at San Francisco (probably it is best that such terrible calamities cannot be foretold), the evidence is important, that the critical condition of the earth was publicly recognized previous not only to it, and the eruption of Vesuvius, but also to the colliery explosion at Nagasaki.

It is still too early to attempt to deduce the lessons which San Francisco will teach with respect to safety against damage to buildings by earthquake and fire. It appears probable, however, that the results will confute the alarmists who have predicted disaster to our modern skyscrapers of steel construction, whenever there should be an earthquake. The older constructions of San Francisco appear to have suffered most, while the modern buildings in which the steel members are securely riveted together appear to be standing plumb in the cases where they have withstood the fire, suffering mostly by the shaking out of their light, exterior curtain walls. There will possibly result from this a more secure method of attaching the exterior walls to the frame, and possibly the design of a different type of wall in place of the present type, which from the architectural standpoint is, anyway, largely a sham.

Copper Production and Consumption.

Upon the receipt of direct reports of their production from all of the producers, with a few insignificant exceptions, the estimates published at the beginning of the year appear to have been largely over the mark. Such overestimates are due chiefly to duplication in the reports. The conditions of copper production are so complex, ore being shipped in some cases to smelters outside of the State of origin for conversion into matte, the matte being shipped to smelters in another State for conversion into blister copper, and the blister copper being shipped to refiners in still another State, that great care is necessary in order to avoid counting the same copper two or three times. Our present statistics are based chiefly on the production of blister copper, but it has not been possible to conform to that principle in all cases. For example, the figures used for Idaho are as reported by the State Inspector of Mines, and represent the production of copper in the form of ore. It is likely that some of this copper is included again in the reports of certain other States, where it has not been possible to make a complete separation. It is always the case, however, that statistics based on actual reports somewhat understate the production rather than overstate it, because there are always various scattering parcels which escape enumeration.

PRODUCTION OF COPPER IN THE UNITED STATES.

(In pounds.)

State.	1904.	1905.
Alaska	2,043,586	4,703,600
Arizona	191,602,958	222,866,024
California	29,974,154	*b* 13,089,993
Colorado	9,401,943	9,854,176
Idaho	5,422,007	6,500,000
Michigan	208,329,248	218,999,753
Montana	298,314,804	319,179,885
New Mexico	5,368,666	5,638,842
Southern States	15,211,086	14,907,982
Utah	47,062,889	51,950,789
Wyoming	3,565,629	2,393,201
Other States *a*	1,418,065	1,550,000
Total	817,715,035	871,634,245

a Including Oregon, Washington, Nevada and South Dakota.
b Partially estimated, especially mines outside of Shasta county.

It appears from the above table that the actual increase in copper production in 1905 was only about 6½ per cent. over the production in 1904. The domestic consumption of copper, on the other hand, showed a very large increase, the total representing an average of about 51,000,000 pounds per month. The details of the consumption are given in the following table:

CONSUMPTION OF COPPER IN THE UNITED STATES.

(In pounds.)

	1904.	1905.
Stock, Jan. 1	230,111,792	208,376,672
Production	817,715,035	871,634,245
Imports	182,292,205	210,724,685
Total supply	1,230,119,032	1,290,735,602
Exports	555,638,552	548,772,403
Stock, Dec. 31	208,376,672	128,980,000
Consumption	466,103,808	612,983,199

The stock on hand at the end of 1905 represented chiefly crude copper in transit and in the process of refining. It is estimated on the basis of 6 per cent. of the Lake production and 17 per cent. of the other production (these figures corresponding to the average time required in each case), plus 5,000,000 pounds of refined copper in first hands.

We have collected statistics of the consumption of spelter, by direct reports from the consumers, which indicate that out of a total consumption of about 200,000 tons, about 26 per cent., or 52,000 tons, were used for the manufacture of brass. Incidentally this gives a rough idea of the consumption of copper for brass-making. If 52,000 tons of spelter were used for that purpose, there must have been at least 104,000 tons of copper used for the same purpose. This figure corresponds to about 34 per cent. of the domestic consumption of new copper in 1905. Taking into account the old copper that is collected for re-consumption, the percentage would be somewhat smaller.

Metallics.

Mild steel containing only 0.05 per cent. carbon, has been made experimentally from magnetic sands of the St. Lawrence river. It is proposed to recover these sands by dredging, and concentrate the magnetite by drying and picking out the mineral magnetically.

Contracts have been awarded by the Carnegie Steel Company for the construction of two large blast furnaces at Rankin, Penn., at a cost of $2,000,000. The furnaces will have a rated capacity of 500 or 600 tons a day. Efforts will be made to have them ready for blast by Jan. 1, 1907.

Crushing rolls, which act mainly by pressure, are supposed to have been devised first in Cornwall about 1800. From their use in that district they gained the name of Cornish rolls, a term which was in common usage up to 15 or 20 years ago. The modern roll has departed so much from its prototype, that the old name is now seldom heard.

The Mammoth Copper Mining Company, of Shasta county, Cal., is going to add two more blast furnaces to its plant, making a total of five; also mechanical roasters, and a reverberatory furnace to treat the fine ore and fine dust. This is another example of the increasing tendency to install reverberatory furnaces at copper-smelting plants.

At the British mine, Broken Hill, the Potter flotation process is now producing a concentrate assaying about 42 per cent. zinc 8 per cent. lead, and 15 oz. silver per ton. At the Block 10 mine, ore containing about 19.6 per cent. zinc is raised to a product assaying 42 per cent. zinc, 8 per cent. lead, and 15 oz. silver per ton, the recovery of zinc in the original ore being about 73 per cent.

It is desirable to provide in all mines a stretcher, which will enable injured persons to be conveyed through stopes, drifts, and shafts, with more comfort than is possible with a makeshift arrangement. The essential feature of such a stretcher must be that the injured persons can be so secured to it as to permit of being conveyed in any position. This is impossible with the stretchers in ordinary use.

The International Metal Company, Ltd., which is now erecting a large zinc-smelting plant at Hamburg, will employ a new process, the essential feature of which is a preliminary distillation of the ore in special furnaces, the zinc being collected therefrom in the form of oxide. The oxide will then be smelted in the usual manner. It is contemplated to smelt low-grade and mixed ores from Australia, Great Britain, Upper Silesia and elsewhere.

In sampling base bullion the punch was originally employed. This was followed by the saw sample, that by the dip sample, and the last by the kettle sample. All four methods are employed at the present time, for while it is acknowledged that the kettle method in general more nearly approaches the correct sampling, yet there are instances where, owing to peculiar conditions, it is not advisable to change from the older methods to the kettle sampling.

Topaz is a transparent gem crystalizing in the rhombic system, generally occurring in right rhombic prisms. The crystals are seldom doubly terminated. The prism faces are usually grooved parallel to the length of the prism. It is doubly refractive and dichroic. The cleavage is highly perfect at right angles to the principal axis. Fracture, uneven to subconchoidal; luster, vitreous; hardness, 8; specific gravity, 3.4—3.6; chemical composition, silica 33.3, alumina 51.7, flourine 15.0.

In the compressed-air street-car service tried in New York some years ago the compressed air was stored in a tank under high pressure, while a second tank containing hot water was used as a reheater, the air being allowed to pass through the water before entering the engine. In trials made with these cars it was found that when using the reheater a car would run over six miles on one charging of the air tank, while without a reheater it would only run between three and four miles.

Some confusion exists with regard to the name of topaz, for in addition to the true topaz, sometimes called "Brazilian topaz, there are the yellow variety of sapphire, sometimes called "Oriental" topaz, a very lustrous gem of considerable value, and the yellow and brown quartz known as "Scotch" or "cairngorm" topaz, which is obtainable in large quantities and of little value. The true topaz, however, resembles these stones only in color, and can easily be distinguished by the difference in the hardness and specific gravity.

A new hoisting rope should be oiled within two or three days of its being put to work. The oiling should be repeated at least once a month during the first six months, and after that every six weeks. In a dry downcast shaft, this may be considered needlessly frequent, but in an upcast, or a wet shaft, it may be required more often. The process of oiling affords an excellent opportunity for examination of the condition of the rope. The oil can be removed by cotton waste, soaked in paraffin, from any part where a defect is suspected.

At the Washoe works of the Amalgamated Copper Company, each 50x20 ft. reverbatory smelting furnace is connected with a 300 h.p. Stirling boiler, and each 102x19-ft. furnace is connected with two 375-h.p. Stirling boilers. From the waste heat of the furnaces, in this way, 4000 h.p. is developed, which is employed in driving the engines of the works. The smelting efficiency of the reverberatory furnaces is unaffected, and no alteration had to be made in the furnace itself; it was, however, found necessary to remove all the baffle plates in the boiler.

Inasmuch as oxide of tin forms fusible compounds both with silicious and basic substances, tin silicate and a stannate being respectively produced, any form of impurity will cause loss of tin in the slags; the first condition of economic tin smelting is, therefore, to keep the proportion of slag formed at the lowest possible limit, which can be done only by smelting nothing but rich ore. It is generally recognized that it does not, as a rule, pay to smelt ore containing less than 65 per cent. of tin, and as a rule the economic percentage is nearer to 70.

Every mining plant should be provided with a convenient equipment for rendering first aid to the injured. This should be kept in the shaft house, in a readily accessible place, and should be under the charge of a responsible official. Under no circumstances should it be tampered with for trivial accidents. The equipment should comprise a complete set of emergency splints, bandages, dressings and tourniquets. The outfit should be contained in a box of suitable size for easy conveyance into the mine, and should be provided with a handle, by which it can be hoisted into a stope, if necessary.

At the mill of the Cactus mine, Beaver county, Utah, improvements in practice have reduced the cost of milling from 75c. to about 47c. per ton, and it is expected eventually to bring the cost down to about 35c. per ton, which would be a low figure for Western practice. The mill saves about 85 per cent. of the copper in the ore. The ore is a pyrite, disseminated in soft porphyry. The concentrate contains about 12 per cent. copper. The ratio of concentration is 10:1. The mill treats about 1000 tons of ore daily. At present the cost of mining is about $1.50 per ton, but steam shovels are to be introduced, which are to reduce the cost of mining to about 40c. per ton.

For some reason, as to which there might be a difference of opinion, the unhealthfulness of work in metalliferous mines appears to be increasing. According to Dr. Haldane, the death rate from lung diseases among miners, between the ages of 25 and 40, living in Cornwall, has recently been from eight to ten times the corresponding death rate among coal miners or iron miners. The report of the Transvaal Miners' Phthisis Commission also showed that an excessive mortality occurs among the underground workers of that district, a mortality which is regarded so seriously that it is said by some that unless the conditions under which the miners work are greatly improved, the shortage in the supply of skilled miners will become as serious an economic problem as is the shortage of unskilled labor.

Colliery Notes.

In the Warwickshire coal field, England, several seams are found lying close together. They are separated only by a few feet of clay and shale and are worked as one large seam. As the coal is very liable to spontaneous combustion, entries are driven down to the dip and the coal is worked backward up-hill, like a stope in a metal mine.

Gas is often given off from the face of coal workings in the form of minute sprays, which escape from small cracks in the coal, and when it is under very high pressure it may be given off as a "blower" which may continue to produce large volumes of gas for several years. The gas can often be turned to commercial account when means are taken to collect it and pipe it to the surface.

Fuel briquets may be made from almost any combustible substance. Some material, such as lignite and peat, can be formed into briquets by pressure alone; but most materials require the addition of some adhesive substance as a binder. Briquetted coke breeze makes a superior and clean fuel when briquetted. There is hardly a vegetable, animal or carbonaceous mineral material which cannot be utilized as a fuel by briquetting.

The quantity of air passing through an entry of given area varies directly as the velocity. If the velocity is doubled, the quantity will also be doubled. As the friction of the air current in a mine varies directly as the square of the velocity, when the velocity is doubled the friction is increased fourfold. This shows the necessity that exists for keeping down the velocity by providing large airways and dividing up and coursing the ventilating currents.

The proper distance apart for entries in coal mines worked by the longwall system depends upon the thickness of the seam, the nature of the roof and the custom of the district. In flat seams the entries are carried in the center of the face, but when the seam is inclined, the rise side should be the longer one in the working bench. Thin seams generally require the entries being not more than 20 ft. apart, on account of difficulties in loading the cars. Cross entries are run about every 600 ft. They are generally ripped and packed as the coal face advances and are driven at an angle with the face.

One of the most effective ways of damping the dust in collieries is by affixing a spray wagon to each train of cars. This spray will deal with the dust on the floors and will increase the moisture in the air current. The efficiency of such a spray can be easily tested by the use of wet- and dry-bulb thermometers before and after spraying. In very deep mines, however, humidity is harmful to the miners, and consequently has to be avoided. In such cases the airways must be increased so that exceptionally large volumes of fresh cool dry air can be coursed throughout the mine.

The Pattsburg method of shaft-sinking has been successfully employed by the Rhein-Preussen collieries, Germany. It resembles the Kind-Chaudron method in principle, but differs from it in certain important details. The iron tubing is forced down by hydraulic rams as the shaft is being sunk, and not lowered down afterward, as in the Kind-Chaudron method. The shaft is bored in one operation and the debris is raised to the surface by a pneumatic pump. This pump consists of an iron pipe about 6 in. in diameter, to which is strapped another pipe 1⅛ in. in diameter. Air is forced down the smaller pipe at a high pressure and forces mud, water and other debris up the larger pipe. The Pattsburg method should not be confused with the recently described Honigmann method. No casing is used by the Honigmann method until the shaft has been sunk to bed rock.

The walling in of a burning area in a colliery requires the exercise of skill in estimating the probable explosive conditions, and the proper thickness of the walls. In certain circumstances two sets of walls may be necessary. In every case proper precautions must be taken to safeguard life while constructing the barriers. It is a good practice to withdraw all the men from the mine excepting those actually needed in building the barriers. Pressure gages and automatic valves to pass the gases to the return airways when the pressure within the walled area rises above a fixed maximum should always be built into the walls, and they should be of ample capacity. If the mine evolves much gas, it will often be necessary to build a number of air-proof iron doors in the entries to enable the men to escape safely after completing the walling.

In some of the larger collieries employing electric underground haulage, the difficulty in collecting loaded cars in the rooms is minimized by employing small gathering locomotives. The feature of these locomotives, which distinguishes them from other types, lies in their ability to operate in mine rooms and on side tracks at a distance from the trolley wire. When so operating, the locomotive is arranged to take current through a flexible insulated cable wound on a drum carried by the locomotive. When it is desired to leave the main tracks, the end of the cable is connected to the trolley wire, the trolley pole is lowered and the locomotive operated by current taken through the cable. As the locomotive runs away from the trolley wire, the cable is automatically paid out, and as the locomotive returns again toward the trolley wire, it is automatically wound up with uniform tension and in even layers.

Correspondence and Discussion.

We invite correspondence upon matters of interest to the industries of mining and metallurgy. Communications should invariably be accompanied with the name and address of the writer. Initials only will be published when so requested.

Readers are invited to use this department for the discussion of questions arising in technical practice or suggested by articles appearing in the columns of this JOURNAL.

Letters shoud be addressed to the Editor.

We do not hold ourselves responsible for the opinions expressed by correspondents.

A Good Suggestion.

Sir—Considering that your office, as well as many others, is constantly in receipt of letters clearly, and even beautifully, type-written, but the signatures to which are a hopeless jungle of hieroglyphics, possessing in all probability individualities characteristic of the author, but entirely undecipherable to the recipient of his message, might I ask you to insert a copy of this letter in the JOURNAL, asking any readers to whom it may apply to emulate my example.

SIG. JOHN SMITH.

[We frequently are obliged to consult the names at the head of a letter, for assistance in deciphering the signature, but this expedient is not always possible. The suggestion of our correspondent is certainly a good one.—Editor.

Colliery Accidents in Nova Scotia.

During 1905 there were 7 lives lost in collieries in Nova Scotia as compared with 13 in the previous year. The total number of men employed in mining coal in the Province last year was 5075, consequently the fatal accidents amounted to 2.57 per 1000 employees and 1 to each 62,090 tons of coal mined. In Pennsylvania the loss of life in the bituminous mines in 1904 amounted to 3.44 per 1000 men employed in the mines, and on the surface; and this corresponded with one fatal accident per each 194,532 tons of coal mined.

Earth Temperatures.

Hugh F. Marriott, in a paper read before the Institution of Mining and Metallurgy, March 15, 1906, concludes that the mean temperature of the earth in the deeper levels of the Witwatersrand increases 1 deg. F. for each 208 ft. increase in depth, or 0.48 deg. F. per 100 ft. of depth. Thus starting from the mean temperature of 68.75 deg. F. at 1000 ft. depth, the temperature at 2000 ft. would be 73.55; at 3000 ft. 78.35; at 4000 ft., 83.15; and at 5000 ft., 87.95.

The Government Coal Tests.

BY SAMUEL SANFORD.

This bulky report of the Coal Testing Operations of the U. S. Geological Survey gives in much detail an account of the equipment of the plant at St. Louis, the methods employed and the precautions taken to insure accuracy in the data obtained. When, early in 1904, the plans of the project were published, I took occasion to point out in the JOURNAL that the results obtained might have far less scientific and commercial value than the promoters anticipated. Happily, as the event has proved, any doubts as to the permanent value of the work undertaken were not justified.

Messrs. Holmes, Parker and Campbell, the committee in charge, found out long before the plant was completed that more coal would be offered for testing than could be handled. They also clearly perceived the importance of careful and frequent checks and the necessity of sampling the seam whence each coal was mined; and finally they recognized that the results would be of most value if attention was concentrated on the needs of the home consumer. As a result they did not attempt too much with the equipment provided, and let the export trade look out for itself. Their choice of mines was largely, no doubt, governed by the location of the plant. Hence small mines in States that rank low as producers received attention not given the great mines of Pennsylvania, Illinois, and Ohio, only four mines in these three States being sampled for the various tests and only six carload lots of coal being received from them, though the States rank first, second, and fourth as producers and their combined output in 1904 was 232,018,848 tons. However, the result has been happy. For had the mines been chosen with regard to present size and value of output, three or four States would have monopolized the plant and the tests would have given results far less reliable and suggestive.

So far as I am aware, no nation has ever undertaken to analyze under standardized conditions and compare in so many ways such a variety of coals. It is difficult to say which of the three volumes of this report is most worthy of commendation, for all have features that call for praise. In Part I, E. W. Parker briefly describes the conditions under which the work was undertaken, the buildings and their equipment, mentions the personnel, and summarizes some of the more striking results. Mr. Campbell gives the location and equipment of each mine visited, the geologic position of the coal seams sampled, and the methods used in sampling. He then discusses the commercial value of coal-mine sampling, based on his experience. His conclusions and particularly his proposed standard method of sampling are, perhaps, the least convincing of his contributions to the volume; they are discussed here at some length as the subject of coal-mine sampling has been comparatively neglected in the discussion of mine sampling generally.

Mr. Campbell states that he and three assistants from the staff of the Survey sampled 50 mines, the number of mines visited by each man being, respectively, 23, 16, 8, and 3. From two widely separated points in a mine a sample was taken by making a cut across the face of the seam, rejecting impurities that would be thrown out in the regular operation of the mine, and quickly breaking down the coal and quartering it to a sample that would fill a quart can. These samples were used as checks on the carloads, 20 tons, shipped from the mines for testing. From a comparison of the analyses, Mr. Campbell finds that lignite and lignitic coals are apt to show a greater percentage of moisture in the car than in the mine sample; that bituminous coals containing over 5 per cent. moisture are apt to show less moisture in the car than in the mine sample; that bituminous and semi-bituminous coals containing less than 5 per cent. moisture generally show a gain of moisture in the car samples; that the general average of the sulphur in all analyses shows an increase in the car sample above that in the mine sample, due to a more rigid exclusion of impurities in sampling than in mining; and that the greatest difference between mine and car samples is in the percentage of ash, the car samples showing on the average a decided gain.

By dividing the sum of the percentages of moisture, sulphur or ash in the mine samples by the corresponding sum for the car samples, Mr. Campbell obtains coefficients which he thinks should be applied to the analyses of mine samples to bring them in closer accord with analyses of the probable run of shipments. He even says that the coefficients obtained in the work under his supervision are approximately correct, and suggests an arbitrary system of sampling to eliminate personal equation.

Mr. Campbell's conclusions appear, however, to be based on insufficient data. Two samples from a seam in a large mine are not enough, their average may or may not represent the average coal shipped. Moreover, Mr. Campbell shows the character of his data when he compares the work of the several samples. His coefficients would have been quite different had the man who sampled 16 mines sampled 30, or had the man who sampled 8 sampled 40. There is nothing to show, also, that the car shipped came from the portion of the vein whence came the samples. If it did not, then the relation between the coal in the car and the coal in the mine may be accidental; if it did, the relations show the personal equation of the sampler. Again, the simple arithmetical averaging of samples is a practice that will not stand criticism. So far as moisture content is concerned his observations are highly interesting, since contained moisture cannot be seen, and the personal equation of the sampler is negligible. With ash and sulphur, however, the case is quite different. What coefficients, for instance, should be applied to samples taken from several seams on a property, each seam differing in ash and sulphur content and in the way the impurities are distributed? And what coefficient should be applied where it is proposed to mine a seam, impurities and all, and rely on some system of cleaning for getting a salable product? Mr. Campbell's automatic method of sampling, which simply rejects impurities above a certain set size and applies predetermined coefficients to the analyses to get the probable shipping analyses, can not hope to compare with the work of an experienced engineer of ripe judgment.

Mr. Campbell's next contribution, on a proposed new classification of coals according to the ratio of the contained hydrogen to the total carbon, is highly suggestive, and an important addition to the literature of coal. He shows how Dr. Persifor Frazer's classification of bituminous, semi-bituminous, semi-anthracite, and anthracite based on fuel ratios, that is, on the quotient obtained by dividing fixed carbon by volatile combustible matter, while it works well enough for Pennsylvania coals, groups all coals having a fuel ratio less than 5, in one class, and makes no provision for lignites. A classification based on fixed carbon alone similarily fails, while one based on calorific value, though satisfactory for lignites and the lower grades of bituminous, does not separate anthracite; hydrogen content alone is also shown to be unsatisfactory. Mr. Campbell demonstrates that the hydrogen-carbon ratio fits all the various classes of coals tested at St. Louis, and proposes a scheme containing nine groups, ranging from wood, through peat and lignitic to anthracite and graphite, but plainly states that as our present knowledge of the chemical composition of coal is imperfect, any scheme of classification must be regarded as provisional. Mr. Campbell's hydrogen-carbon ratio as a basis of classification is to my mind one of the most important scientific results of what was done at St. Louis.

N. W. Lord gives an interesting account of the work of the chemical laboratory. A proximate analysis and a determination of sulphur were made in practically every sample. Ultimate and proximate analyses and determinations of calorific value were made on each car sample. Calorific value was determined by the Mahler bomb calorimeter; ultimate analyses were made in a 25-burner combustion furnace, purifying trains leading to the furnace being arranged in duplicate for air and oxygen; in the absorption train the water was removed by granular calcium chloride, the

carbon dioxide by potassium hydroxide. Nitrogen was determined by the regular Kjendahl method; sulphur by the Eschka method; phosphorus, in coke only, by the molybdate method. In proximate analyses moisture was determined by heating for one hour in an air bath at 105 deg. C.; ash by heating in a crucible until all combustible matter was removed; while for volatile combustible matter the method recommended by the committee on coals of the American Chemical Society (heating one gram for seven minutes in a covered platinum crucible over the full flame of a Bunsen burner) was employed. Apparently no tests of the fusibility of ash, which would have been of interest in connection with the boiler tests, were made.

The most important results of the chemical work whether viewed from a purely scientific or from a strictly commercial standpoint, is the knowledge gained regarding the moisture content of coal. This question has been under consideration by the chemists of the Geological Survey for two years or more, and though the statement may seem surprising, has not been discussed in European technical periodicals until within a year or so. It has been shown that some coals lose moisture rapidly when finely pulverized, that some have also a marked capacity for absorbing moisture from the air; hence all moisture determinations made a few years ago, or those made today without the precautions shown to be necessary, are of slight value. A standard method requires that the moisture content of the air in the laboratory and in the drying oven itself be taken into consideration. The fineness of the sample, and the amount spread on a given area also affect the result. Of high importance to the geologist or engineer who undertakes to sample a coal seam is the demonstration that unless the samples are quartered down as quickly as possible and immediately put in hermetically sealed jars, the moisture determinations may be altogether misleading. A chemist can tell nothing about the original moisture content of a sample shipped in a box or bag.

Part II of the report is a bulky volume in which Professor L. P. Breckenridge describes the equipment of the boiler plant and the methods used in making the boiler tests, 78 in all, of which 70 are regarded as satisfactory and complete in all details. Two Heine 210-h.p. water-tube boilers, a 250-h.p. Allis-Chalmers simple Corliss engine, and a Bullock 200-k.w. direct-current generator constituted the essentials of the plant. A water rheostat was used to equalize the load on the engine. The boilers had plain grates and were hand-fired. The action of the coals on the grate, the amount of clinkers formed, the amount of free ash falling through the grates, and the labor required to handle the fire successfully, were noted. The conditions of the tests made it impossible to conduct more than one test with each coal. The tests were run as nearly 10 hours as consistent with correct results, and the attempt was made to close each test with the same load, condition of fire, water level and steam pressure, as at the beginning. In calculating results the code for boiler-testing of the American Society of Mechhanical Engineers was followed in all particulars. Professor Breckenridge submits the important items of the original data and observations from which calculations have been made for each test.

In spite of the fact that but one test could be made with each coal, yet, as Professor Breckenridge says, the opportunity to test and compare coals in the four important ways, as provided in these trials, the coals having been selected under known conditions at the mines, constitutes a very distinct advance in this line of investigation. It is altogether likely that the tests conducted since the close of the exposition period, with provision for at least three trials of each coal; a system of controlled draft for burning small sizes and the use of continuous registering apparatus for the most important observations will yield results of even greater value to the many persons who are interested in boiler economy. Also, Professor Breckenridge expresses the hope that future tests at the plant will include trials of several types of boilers with the same coal, the comparative efficiency of various types of automatic stokers and hand-firing, the effect of forced circulation on the evaporation of a boiler, and the possibilities of powdered fuel.

Part III contains a greater variety of material than the other two volumes, and also an account of what was from a commercial standpoint the most valuable work done at St. Louis, viz., the demonstration of the possibilities of the gas producer and gas engine in comparison with the boiler and steam engine, and, in particular, the proving of an unexpectedly high efficiency for lignites when used in the producer. This last fact opens all manner of possibilities for cheap power in regions where the lack of high-grade coal has been regarded as a barrier to industrial progess. Criticism based on present prices for producer plants and gas engines and higher depreciation charges has little weight in view of the advance in gas-engine design in the past ten years.

Prof. Robt. H. Fernald, who had charge of the gas-producer tests, describes the apparatus, the methods used, and the manner of working up results. A 250-h.p. capacity Taylor pressure gas producer, and a Westinghouse vertical 3-cylinder engine were used. The engine was belted to a 6-pole, 175-k.w. Westinghouse direct current generator. The load on the engine was controlled by and the energy developed dissipated through water rheostats.

In all 24 different coals and lignites were used, and 22 of the tests were conducted on a 30-hour basis. Owing to the desire to test as many coals as possible, the highest efficiency was of secondary consideration, the aim being to demonstrate the possibility of using the coals in a producer. A second series of tests on the same coals with the object of securing the greatest economy will, Professor Fernald says, show a much smaller consumption of coal per horse-power hour. In the later tests 72 consecutive hours have been allowed for each, of which the first 8 to 12 were spent in studying the behavior of the coals in the producer, and securing the best possible manipulation of the plant.

In spite of the disadvantages mentioned, the data obtained by Professor Fernald in the 18 tests described are so suggestive that they are by themselves a sufficient reason for the establishment of the coal-testing plant. They are given in much detail and are thus summarized by E. W. Parker, in the introduction to Part I:

Bituminous coals and lignites can be used in the manufacture of producer gas, and this gas may be consumed in internal-combustion engines....with a fuel economy of over 50 per cent....It has been shown by comparative tests....that 1 ton of coal used in the gas-producer plant has developed, on a commercial scale, as much power as 2½ tons of the same coal used under Heine boilers with a simple Corliss engine....It has been shown that a gas of higher quality can be obtained from lignite than from high-grade bituminous coals, and that 1 ton of lignite used in a gas-producer plant will yield as much power as the best Pennsylvania or West Virginia coals used under boilers.

Considering that the producer was in need of repairs during some of the tests, that it was operating under conditions which did not permit of its being manipulated to best advantage for each coal, that its adjuncts were not adapted to some of the coals, and that the gas engine was single-acting and was not provided with means for changing the ignition while in operation, criticisms based on the relative showing that might be made by a compound condensing steam engine have little weight. The tests at St. Louis are full of promise for the gas engine and indicate a longer life for our coal fields than can be determined by calculations founded on present methods of generating power.

The briquetting tests conducted under the supervision of Dr. Joseph Hyde Pratt are as valuable for their showing that certain coals can be made into briquets on a commercial scale with the binders supplied and the equipment used, as for demonstrating that many can not. The possibilities of the briquet fuel industry have been so often set forth by inventors and promoters with resulting financial loss to ignorant investors, that an official statement is welcome. A briquet plant to utilize anthracite waste was erected at Rondout, New York, 25 years or more ago, yet the only plants in this country which can be said to have been commercially successful, judged by their output, were those erected to briquet low-grade coal in California. Germany annually manufactures a large tonnage of briquets, which are used for power production and for domestic purposes. The chief draw-

back to the industry in this country is not so much a higher wage rate, since the labor cost can be mininized by automatic machinery, as the high price of suitable binders. In Germany, where the by-product coke oven is the prevailing type and the utilization of by-products is carefully studied, suitable pitch can be cheaply had; also the so-called magnesia cement, a by-product of the great Stassfurth potash salts industry. Another barrier to the growth of an American briquet trade has been the comparatively low price of excellent coal in the densely settled sections of this country.

The experiments conducted by Doctor Pratt, using an English and an American briquet machine, showed very clearly the behavior of different coals and the importance of obtaining suitable binders. In fact, commercially successful briquetting means certain methods and certain binders for certain coals. A positive result of the St. Louis tests was the demonstration of the possibility of utilizing on a commercial scale the slack, now largely wasted from the dry non-coking coals of the Middle West, and from the semi-anthracite coals of Arkansas. It is to be regretted that the equipment of the washing plant did not permit of more convincing tests with washed coals. Tests to determine the possibility of making merchantable coke in a beehive oven from briquets were not conclusive.

Perhaps the least satisfactory work at St. Louis, considering the opportunity, was with the washing plant and the coke ovens. John D. Wick and Fred W. Stammler did all that could have been expected of them under the circumstances, but the equipment at their disposal was not nearly as complete as it would have been had the commissioners been able to purchase apparatus. The washing plant consisted of two jigs, the coking plant of beehive ovens. Now, the working of impure coal seams and the subsequent purification of the coal are matters of great and growing importance; the capacity of by-product ovens, whether of the Semet-Solvay, Otto-Hoffman, or other types, to make good coke out of washed coals that will not coke in a beehive oven, is a subject calling for attention. The two investigations could have been carried out to better advantage at St. Louis than at almost any other point, because the benefaction of impure coals by washing and their subsequent use in the by-product oven, are matters of greater importance to the West than to regions near the remarkable coking coal seams of the Appalachian fields. It is much to be regretted that at a plant where such systematic and painstaking work was done, better equipment could not be had. If the washing plant had included jigs of the Baum type, which have met such favor in Europe, bumping tables of the Campbell pattern, that have been installed at the largest coal-washing plant in this country, and friction separators that are used at anthracite mines, and are being tried at bituminous mines, the results would have been of very great value to the American coal industry. The jigs installed did, indeed, show that certain coals were benefited by their use, but coals vary not only in the ash and sulphur content, but in the manner those impurities are distributed, and to purify some coals such fine crushing is necessary that jigs of the types tested at St. Louis are not the most economical devices. With provision for washing very fine coals, experiments to determine the distribution of sulphur in different coals, whether chemically combined, or as thin flakes along joints, or as aggregations of some size, say above 1/10 inch, would have yielded highly instructive data. In fact, the subject of coal washing calls for comparative tests under standarized conditions with devices of quite different types. Such work can be undertaken by private corporations of large means, but it is not likely that any corporation will in the near future test such a variety of coals as were available at St. Louis.

In conclusion, I believe that the chief value of the work so ably carried out under the supervision of Messrs. Parker, Holmes, and Campbell is its demonstration of the importance of standardization. Done at a time when the public is coming to realize the utility of waste prevention and the commercial value of small economies, it sets a standard for other tests, not only of fuels but of materials of construction, which can be undertaken to better advantage and to the greater benefit of the public under government supervision than by an individual or by a corporation or combination of corporations.

Spanish Mineral Trade.

Imports of fuel into Spain in the month of January were 174,907 tons of coal, and 12,438 tons coke. Exports of minerals for the month are given by the *Revista Minera* as follows, in metric tons:

	1905.	1906.	Changes.
Iron ore	427,080	872,318	I. 445,288
Copper ore	93,596	88,809	D. 4,787
Zinc ore	8,754	11,593	I. 2,839
Lead ore	676	288	D. 388
Manganese ore	1,973	3,117	I. 1,144
Pyrites	39,620	79,317	I. 39,697
Salt	22,466	19,974	D 2,494

Exports of metals included 11,095 tons iron and steel, against 7682 tons in 1905; 712 tons copper, against 573 tons; 2975 tons copper precipitate, against 1108 tons; 42 tons spelter, against 8 tons; 11,834 tons of lead against 11,691 ton last year.

A brass cleaning compound can be made of oxalic acid, 1 oz.; rotten stone, 6 oz.; and enough whale oil and spirits of turpentine of equal parts, to mix. This is made into a paste. A solution of potassium cyanide is also used for the purpose.

Horace F. Brown.

April 15, while in Chicago, Horace F. Brown, mining engineer and inventor, expired suddenly of heart failure. Until the very last moment Mr. Brown was apparently in the best of health. He was born in Litchfield, Mich., in 1840, and for more than 40 years was actively engaged in mining and particularly in devising ways to improve the prevailing methods. His first work after leaving school was in free-gold mining at Plumas, Cal., in 1862. This led to mine surveying and other engineering work of like nature. From Plumas county he went to the Reese River district in Nevada and erected a free-silver mill for a company from Butte county. It was a counterpart of mills then in use on the Comstock Lode at Virginia City, but the Reese River ores were of a totally different nature, so that the mill was a failure, and it became necessary to change it over to a chloridizing mill. For this purpose hand-rabbled roasting furnaces were erected and all of the ore was roasted with salt for changing the silver contents to chloride. This was his first experience in the more complex methods of ore treatment. From Reese River he went to Virginia City and worked in some of the silver mills of Carson Valley. After some experience in the lead smelting camps of Nevada, he returned East, and spent some time in coal mining in Pennsylvania, Indiana and Illinois, trying to introduce a coal-mining machine he had patented, which was the first machine built in the United States of the continuous-cutting type. It was successful, but there was at that time a prejudice, not only among the miners, but among the mine bosses and superintendents as well, against the introduction of machinery for this purpose. He had, however, the satisfaction of seeing the continuous-coal-cutting mining machines now in use built upon his lines, but his patent expired before coal-mining machinery came into general use.

When in Pennsylvania he put in the Fall Brook coal mines, the first underground wire-rope haulage system introduced in the State. He was 2½ years with the Hecla Consolidated Mining Company, in Beaverhead county, Montana. At this plant the principal product was lead bullion, but as the ores contained a good deal of copper, quite a large proportion of the mineral value recovered was in the form of a leady copper matte. This he was obliged to re-smelt for the purpose of eliminating its lead contents, and in a measure the silver values, and for enriching the copper contents. All of the product was marketed in Germany. He devised and installed some large water-jacket furnaces, the iron work of which was built by Frazer & Chalmers. Owing to the success of this plant others desired to copy this machinery, and he left there with the purpose of installing similar

works at other points, and was for 2½ years superintendent of the Alta-Montana Company's plant near Helena, Montana. This property consisted of five mines, one wet concentrator for lead ores, one dry concentrator for lead-silver ores, one 20-stamp free gold mill, one 15-stamp chloridizing silver mill, and a 50-ton lead-silver smelter. He made the designs and superintended the erection of this entire plant, except the free-gold mill. At this he did all the metallurgical work and was directly in charge of the mining development. He finally became so impregnated with lead and arsenical poison that he was forced to leave the lead smelters and engage in the manufacture and erection of mining machinery, the designing and erection of metallurgical plants, and work as consulting engineer. He organized the Western Iron Works Corporation, of Butte, Montana, and was its manager. While at the Montana Company's plant, he became impressed with the disadvantages in the prevailing practice of ore roasting, and devised and patented the Brown system of ore roasting furnaces, which is now a standard type. He was obliged to go to law to protect himself against infringers of his device. For six years he was engaged in suits to defend his patents, but finally prevailed against the infringing devices.

The condensing chamber which he devised, and which was an adaptation of the old bag process, was adopted by the Omaha & Grant Smelting Company in its works at Omaha, and is still in use for the recovery of volatile fumes from lead-smelting plants. He was also the inventor of numerous other devices, which have come into use in various plants. Recently he had given much attention to the design and improvement of concentrating plants. Up to the last, he was constantly at work, and always looking for the possible improvements suggested by his active mind.

Mining in the Yukon.

SPECIAL CORRESPONDENCE.

The publication of the report for the fiscal year ended June 30, 1905, of the Department of the Interior for Canada, in which is included the report for Yukon Territory, makes available for comparison the results of mining operations in that Territory during the period mentioned.

The decrease in revenue received at the gold commissioner's office, Dawson, was comparatively large, as exhibited by the following totals over a period of three years: Receipts for year 1902-3, $289,525; for 1903-4, $216,834; for 1904-5, $146,031. The falling off in the last year as compared with the receipts of the year immediately preceding was nearly one-third. The report shows the principal items of decrease to have been: Free miners' certificates, $15,890; placer mining grants, $26,765; renewals of placer mining claims, $6,875; re-locations of placer mining claims, $6140; and registered documents (placer mining) $5868. The assistant gold commissioner observes in his report: "The decrease in revenue from mining dues is accounted for by the fact that the diggings in the Dawson mining district on Bonanza, Eldorado, Hunker, Gold Bottom, Last Chance, Bear creek, Dominion, Gold Run, Sulphur, Quartz, and their tributaries, do not give at present to the individual miner the same opportunity for staking new ground or for re-locating old ground as in the past, and that there has not been any new strike of placer ground of any importance in the Territory during the last fiscal year. As a consequence a large portion of the population of miners in this Territory left the country during the year for the Tanana diggings, in Alaska, and a certain proportion of the population went back to the outside.

"Notwithstanding the decrease referred to with respect to re-locations and renewals of placer mining claims in that portion of the Dawson district above mentioned; the conclusion should not be come to that this part of the Territory is worked out or about to be abandoned. The creek claims are far from being worked out, and operations will be carried on for a considerable period longer by ordinary placering or by some other mining method. The hill and bench claims in the Bonanza and Hunker watersheds cover a large area of ground which can be worked profitably by gravitation water, but as the supply of such water at the present time is limited, only a small portion of the claims in question has been worked. If, however, large conduits of water bringing a steady supply during the whole of the summer season, are constructed, the owners of those claims will be enabled to carry on mining operations for a number of years, and to increase materially the production of gold in the Territory.

"There is also a large area of ground in the same portion of the Dawson mining district which will likely be worked by means of dredges in the near future, in view of the successful results achieved by dredging operations on Bonanza creek during the last four years; also in view of the large dredge being installed at the mouth of Bear creek, and of other installations of that kind now being made."

The report further states that the several mining districts of Forty-mile, Sixty-mile, Stewart river and Pelly, which had been separate recording districts, have been merged into the Dawson mining district, while Hootalinqua has been included in the Whitehorse district. Concerning other districts, still separate, the report states: "The Whitehorse district seems to be stationary; with the exception of the diggings on Livingstone creek, Cotton Eva creek, and other creeks tributaries of the south fork of the Big Salmon river, which are now attached to the Whitehorse district, there were no placer-mining operations carried on during the last fiscal year.

"As regards the Kluane mining district, it would appear from the returns at this office covering the period extending to May 31 last, that a very large proportion of the placer-mining claims which were staked and recorded in 1903 and 1904 had been abandoned, and that claims have been kept in good standing only on Burwash, Arch, Fourth of July, Virgin and Bullion creeks, where sufficient prospecting and development work has been done to warrant the mining recorder for that district in stating, in a report received some time ago, that the future of the camp is assured in that part of the country.

"The Duncan creek district has given much encouragement to the miners interested in that section of the Territory, especially on Highet, Ledge, Edmonton and Cascade creeks, and has attracted a good deal of attention during the last year.

"The Clear creek district would appear to be on the decline and very little interest seems to have been taken in it latterly."

Information relating to coal in the Yukon is as follows: "During the year ended June 30, 1905, royalty was paid on 699 tons of coal. In addition to this, 2807 tons were mined which were not subject to royalty, and there are 1700 tons on which royalty is now due; a total of 5200 tons. At Tantalus coal is being worked by C. E. Miller, who has a contract for 3000 tons, partly filled. There are employed at the mines an average of 14 men. The output is 35 cars per day, about 5 cars per man actually working drift. Two tunnels have been run into the seam a distance of 450 ft. each, and cross-cuts opened for these. Coal is run out in cars on a wooden railway, and then elevated by means of a hoist to the screen. The seam dips at a sharp angle up stream and runs laterally at almost right angles to the river on the left bank. As yet no trace of a corresponding seam has been discovered on the opposite side of the river. The coal is bituminous, intermingled with stringers of rock and, unfortunately, very dirty. The Coal Creek Company is also mining coal, on Coal creek."

From the report of the Comptroller it is learned that "the local revenue and expenditure of the Yukon Territory administered through the comptroller's office during the year was: revenue,, $429,860; expenditure, $434,360." The total royalty collected was $205,522 on gold, coal, timber, etc.

A good cement for switchboard repairs, where iron has to be fastened to marble is made of 30 parts plaster paris, 10 parts iron filings and ½ part of sal ammoniac; it is mixed with vinegar to a fluid paste for use and made freshly, for it solidifies if allowed to stand.

Abstracts of Official Reports.

Carnbrea and Tincroft Mines, Ltd.,

This Cornish company has issued a much improved report for the last half of 1905. This company works tin ore of lower grade that the Dolcoath, but it produces also some copper, arsenic, and wolfram. During the half year 29,600 tons of ore were crushed, yielding 496 tons of black tin, or 30.72 lb. per ton. This yield is slightly higher than in previous years. The average price realized was £84 per ton, a lower price than is given for Dolcoath black tin, but much higher than that received during previous years and comparing with £70 a year ago. The receipts of the company from all sources were £34,000, as compared with £21,700 a year ago, and the net profits were £6690. During the last few years the balance has been more often on the wrong than the right side. At these mines also the developments continue to expose richer ores; so that, as in the case of Dolcoath, the present outlook is very favorable.

Utah Consolidated Mining Company.

Development work aggregated 12,444 ft., nearly 5000 ft. more than in 1904. This resulted in opening up enough ore to offset the quantity extracted during the year. The total ore reserves on Dec. 31, 1905, amounted to 1,000,000 tons, or about four years' supply.

Expenditures in connection with the smelter-smoke problem were large during the year. A method of treatment has been devised and put in operation on a small scale. This is expected to render the smelter gases harmless and return a revenue from the recovery of values in the slag.

The figures for the last two years are:

	1905.	1904.
Pounds of copper	17,264,474	13,553,483
Tons ore treated	286,198	233,700
Pounds per ton	60.3	58.0
Ounces of silver	374,685	268.879
Ounces of gold	28,290	23,373
Gold and silver per ton	$2.70	$2.57
Sales	$3,361 080	$2,250,799
Stock on hand and misc	117,186	209,175
Total earnings	$3,478,266	$2,459,974
Expenses	1,590,881	1,295,626
Balance	$1,887,385	$1,164,348
Dividends	1,350,000	900,000
Surplus	$537,385	$264,348

This company probably produces the cheapest copper of any in the United States.

The Consolidated Mining and Smelting Company of Canada, Ltd.

The St. Eugene, Centre Star and War Eagle mines, the Trail smelter, and the Rossland Power Company, of Rossland, British Columbia, have been consolidated under the name of the Consolidated Mining and Smelting Company of Canada, Ltd., with a total capital of $5,500,000; of which $4,698,888 in stock has been issued, $801,112 in stock remaining in the treasury. The Consolidated company started with a cash working capital of $596,669.57, which is invested in ores and products in process of treatment and in transit. The company also has a liquid asset, in the shape of fuel, fluxes and supplies, valued at $202,220.43.

Deducting operating, development and construction expenses from the net receipts from ore shipments as above, the net profits of these properties during 1905, including the profits of the smelter, were over $700,000. Due to the consolidation of the properties and to the larger tonnages handled, much lower grade ore can now be profitably treated than formerly.

Development work in all the mines during the last few months has been satisfactory; there is reason to expect a continuation of known ore shoots, as well as the development of new ones.

In the Centre Star over 100,000 tons of $10-ore is developed; and 9000 tons is sent to the smelter monthly.

The War Eagle reserves are estimated at 45,000 tons, valued at $10 per ton. About 5000 tons is being shipped monthly. The shipment last year from this mine amounted to 60,860 tons, valued at $690,-269.

The available ore in the St. Eugene mine is estimated at 150,000 tons.

The company's smelter at Trail, B. C. (which comprises a complete up-to-date lead and copper reduction works, and an electrolytic lead refinery) treated 240.000 tons of ore during 1905 and shipped as in the table given herewith:

	Value.
1,359,911,068 oz. of silver	$ 806,658.81
82,644,311 " " gold	1,708,257.91
4,571,764 lb. " copper	563,249.87
13,382,050 " " lead	397,580.70
	$3,475,747.29
Refinery production from outside bullion	320.000.00
Total production, 1905	$3,795,747.29

The smelting business of the company has greatly increased lately, and promises to make a record during the present year.

In the report covering 1905, reference is made to the negotiations carried on for several months with a view of acquiring the Le Roi mine. They were unsuccessful, owing to the refusal of the English shareholders to agree to the proposed arrangement.

Patents Relating to Mining and Metallurgy.

UNITED STATES.

The following is a list of patents relating to mining and metallurgy and kindred subjects, issued by the United States Patent Office. A copy of the specifications of any of these will be mailed by THE ENGINEERING AND MINING JOURNAL upon the receipt of 25 cents. In ordering specifications, correspondents are requested to name the issue of the JOURNAL in which notice of the patent appeared.

Week ended Apr. 17, 1906.

817,746. ELECTROSTATIC APPARATUS—Lucien I. Blake, Lawrence, Kan. Filed Jan. 23, 1905.

817,749. ELECTRICAL APPARATUS FOR DETERMINING THE LOCATION OF METALLIC ORES.—Fred. H. Brown, Los Angeles, Cal. Filed Mar. 31, 1902.

817,767. ELECTRIC FURNACE.—John F. Hammond, Brewster, N. Y. Filed Apr. 13, 1905.

817,899. PROCESS FOR PRODUCING FUEL FROM PEAT BY MEANS OF THE ELECTRIC CURRENT. Joseph B. Bessey, London, England. Filed Oct. 5, 1905.

818,015. ROCK DRILL.—Robert Binnie, Sr., Bolivar, Pa. Filed Aug. 26, 1905.

818,033. GAS FURNACE OR COKE OVEN. Heinrich Koppers, Essen-on-the-Ruhr, Germany. Filed Feb. 7, 1905.

818,070. RETORT.—Richard Ziesing, Cleveland, Ohio. Filed Dec. 29, 1903.

818,076. APPARATUS FOR CASTING METALS.—Adolph C. Clark and Thomas J. Clark, Perth Amboy, N. J. Filed Dec. 12, 1905.

818,147. APPARATUS FOR HEATING METALS.—Frederick J. Clinch-Jones, Leamington, England. Filed June 1, 1905.

818,174. PROCESS OF RECLAIMING WASTE GOLD AND OTHER VALUABLE METALS FROM WATER AND OTHER LIQUIDS.—Charles E. Holland, New York, N. Y., assignor to The Holland Metal Recovery Company, a corporation of New York. Filed June 5, 1905.

818,188. ART OF MINING.—Albert G. Parker, Platte Center, Neb., assignor of one-half to Christian M. Gruenther, Platte Center, Neb. Filed Feb. 2, 1905.

818,192. PROCESS OF MANUFACTURING CAUSTIC ALKALIES AND ZINC SULPHIDE. Charles Ranson, Brussels, Belgium, assignor to Henry William De Stucklé, Dieuze, Germany. Filed Oct. 3, 1904.

818,266. COKE-OVEN.—Heinrich Koppers, Essen-on-the-Ruhr, Germany. Filed Sept. 7, 1904.

818,328. PRELIMINARY BREAKER FOR CRUSHERS AND PULVERIZERS.—Milton F. Williams, St. Louis, Mo., assignor to Williams Patent Crusher & Pulverizer Company, St. Louis, Mo., a corporation of Missouri. Filed July 31, 1905.

818,334. ORE-CONCENTRATOR.—Brig Ballantyne, Sumpter, Ore. Filed May 17, 1904.

GREAT BRITAIN.

The following is a list of patents published by the British Patent Office on subjects connected with mining and metallurgy.

Week ended Apr. 7, 1906.

5260 of 1905. FLOTATION PROCESS.—Sulman, Picard & Ballot, London. A modification of the flotation process for separating sulphides from gangue, consisting in bringing dry powdered ore on to the surface of acidified water, the metallic particles floating and the gangue falling.

12,271 of 1905. DEEP BORING.—P. E. Lewis, Johannesburg. Improved apparatus for recording the dip of deep boreholes.

13,955 of 1905. SLATE OR COAL PICKER. G. F. Zimmer, London. An apparatus for separating mineral from coal, consisting of a vibrating traveling trough with various perforations in the bottom.

16,321 of 1905. CABLE GUIDES.—K. Austin, London. Improvements in hoisting machinery for mines, using a series of cable guides to prevent the cable being dragged off the sheave.

19,655 of 1905. ZINC FURNACE.—E. Dor-Delattre, Budel, Holland. In gas-fired zinc furnaces, improvements in the arrangement of the openings for the gas to ensure more even heating of the furnaces.

22.744 of 1905. SHAFT-SINKING CAGE.—C. Walker, Doncaster. A self-contained drilling apparatus for use in shaft sinking, containing water and compressed-air reservoirs, arms and drills, with a receptacle for spare drills, and space for a man to stand in; the whole apparatus and the operator may be raised and lowered together.

22,745 of 1905. SHAFT LINING.—C. Walker, Doncaster. An improved method of guiding the linings of shafts in their descent.

26,556 of 1905. COAL WASHING.—Campbell, Binnie & Reid, Hamilton. Improved methods of controlling the water supply in coal washers.

1323 of 1905. TUBE MILL.—M. F. Abbe, New York. In tube mills, improved supporting and driving feed and discharge mechanism.

Personal.

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

Hamilton Ball, of New York, has paid a visit to Breckenridge, Colorado.

Fred C. Shaffer, of Boulder county, Colo., is inspecting mining interests in Nevada.

S. A. Worcester, of Victor, Colo., is making a professional visit to the Liberty Bell mine at Telluride.

Charles S. Downing, of Kansas City, has been looking into the mining prospects of Breckenridge, Colorado.

F. C. Berendes, cashier Boulder Bank, Boulder, Mont., is invesigating the mining situation in Mexico.

Thomas Harris left Breckenridge, Colorado, recently for Alaska for a five months' examination trip.

G. N. Raymond, editor of the Durango (Colorado) *Evening Herald,* has been several months in Mexico.

E. A. Reser, of New York, is looking after mining interests in Gilpin and Boulder counties, Colorado.

J. J. Wilkinson, manager of a gold mine in Java, is spending a vacation at his home in New South Wales.

J. M. Callow, president of the General Engineering Company of Salt Lake City, has returned there from Europe.

H. H. Hardinge was in Kansas City, Mo., recently He is now on his way to Mexico on professional business.

Axel Sahlin, of Brussels, Belgium, who has been in the United States for some weeks, left for Europe last week.

Dr. J. E. Cumings has been appointed to the position of associate professor of geology of the University of Indiana.

E. J. Adams, of Apex, Colo., is in southern Colorado looking after the interests of some Eastern stockholders.

T. T. Rayborg, of New York, was in Butte recently, investigating the prospects for establishing a zinc concentrator.

A. G. Brownlee, of the Stanley Mines Company, of Idaho Springs, Colo., is making a business visit to eastern points.

M. F. Allen, of Chanute, Kan., accompanied by G. M. Fenstermacher, is investigating the oilfields in Chiapas, Mexico.

Percy E. Barbour and J. G. McNulty have gone to New Mexico to examine some mining property for Eastern interests.

James T. Hogan has severed his connection with the late Gold Pan Mining and Engineering Company, of Breckenridge.

John C. Fleschhutz, of Central City, Colo., is examining mining property at Ouray, Colo., in the interests of Eastern capitalists.

S. C. Hazlerigg, of Joplin, Mo., has been visiting the Platteville zinc district in Wisconsin and examining several mines there.

A. D. Hatfield, treasurer of the Wellman-Seaver-Morgan Company, Cleveland, sailed for Europe recently for a stay of two months.

Herbert Akroyd-Stuart, patentee of the Hornsby-Akroyd gas engines, is visiting several of the more important gold fields in Australia.

Jesse Knight, of Provo, Utah, has resigned the management of his Tintic mining interests in favor of his son, J. William Knight.

R. H. Emtage, of Georgetown, Barbadoes, B. W. I., is in New York on business connected with his asphalt mines in the West Indies.

Prof. Raphael Mendola, chemist at the Finsbury Technical College, London, has been appointed an Officier de l'Instruction Publique, France.

Epes Randolph, president of the Cananea, Yaqui River & Pacific Railroad, has returned to Tucson, Ariz., from a trip to Mexico City.

William B. Dennis, manager of the Black Butte quicksilver mine in Oregon, has been visiting New York. He has now returned to Oregon.

George K. Kimball, Jr., and W. H. Wiley, of Idaho Springs, Colo., have been examining mining property in California for Eastern investors.

Percival Furber, of New York, president of the Mexican Oil Fields, Ltd., is in Mexico on his occasional inspection of the company's properties.

Lafayette Holbrook, president of the Grand Central Mining Company, Tintic district, Utah, is making a round-up of Nevada and California camps.

L. D. McCall, of Chicago, Ill., was a visitor to Gilpin county, Colo., recently, to look after the interests of the Jefferson-Calhoun Mining Company.

Dr. Thomas A. Jaggar, professor of geology at the Massachusetts Institute of Technology, has sailed for Italy to make observations on Mount Vesuvius.

L. J. Mountz, manager of the Imperial Mining and Milling Company, operating at Apex, Colo., has returned after a business visit of several weeks to the East.

Dr. Chas. S. Palmer, of New York, will attend the ninth General meeting of the American Electrochemical Society, which will be held at Ithaca, N. Y., on May 1.

W. H. Gay has been placed in charge of the drilling operations carried on by the Abundance Mining and Milling Company in Yuba Dam Flats, Summit county, Colorado.

J. Backhouse has resigned the position of superintendent of the Golden Horseshoe mine, Kalgoorlie, to become manager of the Craiggiemore mine, Laverton, West Australia.

George Wesley Davis, of the American Consolidated Company, has gone from San Francisco to Butte, to attend a conference of representatives of the company with C. Janin, of Paris.

W. M. Laird, of Pittsburg, Penn., has been at Idaho Springs, Colo., attending a stockholders' meeting and looking after interests of the Pittsburg Consolidated Mining and Tunnel Company.

J. J. Bennett, manager of the Kimberly group of claims at Golden camp, on Palmer mountain, Okanogan county, Wash., has gone to Columbus, Ohio, on business connected with that property.

William Kirkpatrick, assistant secretary of the Pittsburg & Montana Copper Company, and representative of the interests of Ralph Baggaley in the company, has returned to Butte from a business trip to the Pacific coast.

E. W. Beidler, superintendent of the Palmer Mountain Tunnel and Power Company, of Loomis, Okanogan county, Wash., has gone to San Francisco, whence he will go to New York on a visit and a well-earned vacation.

Louis T. Sicker, until recently mechanical engineer for the Amalgamated Copper Company at Butte, Montana, and the Lewis & Marks Engineering Company, is now on his way to Johannesburg, Transvaal.

C. W. S. Turner, operator of mining properties at Broad Run, Va., accompanied by Carlos Cadmus, mining engineer, has been in New York on mining matters. Mr. Cadmus sailed for Havana, April 18, on professional business.

Thomas and Charles Harris have returned to Breckenridge, Colo., from the United States of Colombia, South America, where they had been for several months with Ben Stanley Revett on a trip of examination of placer tracts

James Gayley, vice-president of the United States Steel Corporation, has received the degree of doctor of science from the University of Pennsylvania, in recognition of his original work in analytical chemistry and metallurgy.

Richard Peters, Jr., formerly secretary of the Solid Steel Casting Company, Chester, Penn., and afterward connected with a Southern blast-furnace operation, is now engaged in the development of white marble deposits at Talladega, Alabama.

A. E. Stillwell, president of the Kansas City, Mexico & Orient Railroad, who has just returned from Mexico to Kansas City with one party of Eastern capitalists, is preparing to leave at once with another party of English and French capitalists.

F. E. House, president and manager of the Michigan & Iron Range Railroad Company, spent April 14 and 15 in Butte. He was accompanied by C. E. Potter of

Duluth; W. C. Brown, manager for Paine & Webber in Duluth; A. W. Taussig of Duluth and B. J. Taussig of St. Louis. The party was on the way from Duluth to San Francisco and stopped in Butte to see the North Butte mines, in which they are interested, and visit the Washoe smelter.

Obituary.

Henry Ward Beecher Howard, assistant secretary and treasurer of the American Institute of Mining Engineers, died April 16 at his home in Brooklyn, N. Y. He was 57 years old and a graduate of Yale. After leaving college he did newspaper work in New York for several years, and later became bursar of the Brooklyn Polytechnic Institute. He leaves a widow and a daughter.

Francis Louis Sperry, discoverer of the mineral known as sperrylite, died of nervous exhaustion at his home in Tallmadge, O., April 17, at the age of 44 years. Mr. Sperry was widely known in Canada and the United States as a mineralogist and expert chemist. He was a graduate of the Sheffield Scientific School of Yale University. After graduation he took a position with the Canadian Copper Company at Sudbury, Ont., and while connected with it discovered the mineral which bears his name, and which is one of the sources of platinum. On leaving his position in Canada he went to Germany for further study, and later rereturned to this country, practicing as mining engineer in New York and Buffalo. Mr. Sperry was a member of the American Institute of Mining Engineers. He leaves a wife and two children.

Professor Pierre Curie was killed on April 19, in Paris, where he was run over by a wagon, on the Place Dauphine. Professor Curie, together with his talented wife, Madame Marie Skladowska Curie, was a joint discoverer of radium, which was one of the most unique chemical wonders of the Nineteenth Century. This discovery was positively announced toward the end of 1898, and was made by following an investigation on the peculiar Becquerel rays emanating from uranium compounds. Professor Curie was born in Paris in 1859, and was educated at the Sorbonne, specializing in chemistry. The lady whom he married was of Polish descent. She was, at one time, his pupil, and was herself a brilliant investigator of chemistry; indeed so closely interwoven were the labors and success of these people, that the world at large has always been in doubt as to which deserved the greater honor. At all events, several medals and prizes were awarded to them jointly. Professor and Mrs. Curie represented the highest personal and scientific character, being influenced mainly by the decoration of the Legion of Honor, from motives of pure scientific modesty.

John H. Fraser, night foreman of the mines of the South American Development Company, at Zaruma, Ecuador, was shot from ambush, and instantly killed on the morning of April 1, as he was returning from the mine office to his room. His assassin, or assassins, used a shot-gun loaded with slugs at close range, and these passed through or close to the heart. After he had fallen he was gashed with a knife about the head and in the left side. The Ecuadorians who are suspected of the crime, had no provocation, except that they had been subjected to discipline, and the dastardly act can be traced to no more serious cause than the withholding of a shift's pay. Mr. Fraser was an Englishman, 34 years of age, and had relatives at Manchester, and other places. He was graduated from King's College, Cambridge, and afterward went to the mining academy at Clausthal, Germany, for the study of mining engineering. He filled a three years' engagement in the Dutch possessions in South Borneo, and later went to Mexico, where he was with the Mazapil Copper Company at Conception del Oro, Zacatecas, until September, 1905, when he went to Ecuador, intending to remain three years. The deceased was a man of unusual force of character, and of many accomplishments, quiet, studious, master of several languages, and especially conscientious in matters of duty, and his tragic death has cast a gloom over the few Americans and Europeans in the Zaruma camp. He was a life member of the American Institute of Mining Engineers.

Societies and Technical Schools.

American Mining Congress—At a meeting of the executive officers of the American Mining Congress, held recently in Denver, the place of the annual meeting of the congress was determined and the date set. The ninth meeting will be held in Denver, Nov. 13 to 17. Matters relating to the proposed mining temple were discussed, and it was proposed to raise the money by direct subscription. The officers will meet again in May to consider plans for the building. The directors appointed committees to make the necessary preliminary arrangements for the meeting.

Iron and Steel Institute—The annual meeting of the Institute will be held at the rooms of the Institute of Civil Engineers in London, May 10 and 11 next.

The following is a list of papers that are expected to be submitted:

1. "The Influence of Silicon, Phosphorous, Manganese and Aluminum on Chill in Cast Iron." By E. Adamson, West Hartlepool.

2. "The Influence of Manganese on Iron." By Professor J. O. Arnold, Sheffield.

3. "The Relation between Type of Fracture and Microstructure of Steel Test Pieces." By C. O. Bannister, London.

4. "Compression of Steel Ingots in the Mould." By A. J. Capron, Sheffield.

5. "The Manufacture of Rolled Solid Steel Car Wheels and Tires." By. P. Eyermann, Wisconsin.

6. "Brittleness in Thin Steel Sheets." By E. F. Law, London.

7. "Chainmaking Machinery." By E. Lelong, Couillet, Belgium.

8. "The use of Oxygen in removing Blast-Furnace Obstructions." By C. de Schwarz, Liège.

9. "Volume and Temperature Changes occurring during the Cooling of Cast Iron." By Prof. Thomas Turner, Birmingham.

10. "The Influence of Copper in Steel." By F. H. Wigham, Wakefield.

The following reports on work carried out during the past year by holders of Carnegie research scholarships will be submitted:

1. Hardness of the Constituents of Iron and Steel. By Henry C. Boynton, Cambridge, U. S. A.

2. Heat Treatment of Wire. By J. Dixon Brunton, Musselburgh, Scotland.

3. Quaternary Steels. By L. Guillet, Paris.

4. Influence of Carbon on Cast Iron. By W. H. Hatfield, Sheffield.

5. The Preparation of Carbon-free Ferromanganese. By E. G. Ll. Roberts and E. A. Wraight, London.

6. Deformation and Fracture in Iron and Steel. By Walter Rosenhain, Birmingham.

Industrials.

The catastrophe at San Francisco resulted in the complete destruction of a number of engineering works devoted to the manufacture of mining machinery and appliances. Many of these establishments were world-famous and had business transactions with every mining region. They were full of orders and had large mining machines in all stages of construction when they were overwhelmed by the elements. This will result in some delay in the execution of their contracts, but we feel sure their customers will willingly submit to a small amount of inconvenience and extend them a little time. Fortunately many of the larger firms have subsidiary works in the vicinity of San Francsco and in other Pacific coast towns, and in a week or two they will be enabled to resume business as usual. Those firms which had factories ing in the destroyed city only may not be able to resume quite so soon; but each firm will start rebuilding within the course of a few weeks and will have new plants on hand when the buildings are ready to receive them. We confidently believe that customers of the injured firms will stand by them in their misfortunes.

The John A. Roebling Company, which was burned out at San Francisco, has made arrangements to supply customers from Oakland.

The Cling-Surface Company, of Buffalo, N. Y., manufacturers of Cling-Surface for belts and ropes, has moved into a new building, which it has erected in Buffalo.

The Sunday Creek Coal Company has decided to establish works at Athens, Ohio, where it will manufacture its own mine cars and other machinery, as well as make repairs for its mines. The company operates a number of collieries in the Hocking Valley district.

Announcement is made of the opening of a branch office in Columbus, Ohio, by the Power and Mining Machinery Company, Milwaukee, Wis. This new office is located in the Columbus Savings and Trust Building, with William A. Heartt in charge as district manager.

The National Carbon Company, Cleveland, Ohio, is installing in its works at Clarksburg, W. Va., a 600 brake h.p. Koerting gas engine supplied by the De La Vergne Machine Company, of New York. The engine will be used for general power purposes and will operate on natural gas.

C. Frank Schwep, who has been at the head of the purchasing department of the Ingersoll-Sergeant Drill Company, for the past 13 years at the shops at Easton, Penn., and Phillipsburg, N. J., has been appointed general purchasing agent of the Ingersoll-Rand Company, with headquarters at 11 Broadway, New York.

The Pelton Company has increased its pipe works in the East, and is now prepared to turn out sheet-steel riveted pipe of any length, diameter or thickness, having exceptional facilities for the manufacture of this class of pipe, as well as lap-welded pipe in all diameters and thicknesses for high-duty power-transmission lines.

The Ellsworth Coal Company, of Ellsworth, Penn., formerly known as Jas. W. Ellsworth & Co., who are among the largest individual coal operators in the Pittsburg territory, recently purchased a 500 k.w. Allis-Chalmers rotary converter for general mine service, 600 volts, and wound for 3 phase, 25 cycles. This machine will be built at the electrical works of the Allis Chalmers Company in Cincinnati.

The Pfannmueller Engineering Company had been incorporated in Chicago to do a general engineering and contracting business. The officers are: F. E. Pfannmueller, president, S. D. Boynton, vice-president and consulting engineer and E. M. Mills, secretary and treasurer. The company will make a specialty of designing and installing complete power plants. The principal offices will be at the First National Bank Building, Chicago.

William A. Bole, in consequence of his election to the vice-presidency of the Westinghouse Foundry Company, has resigned his position as manager of works of the Westinghouse Machine Company. This company, however, retains Mr. Boles as consulting engineer. Henry L. Barton, formerly general superintendent of the East Pittsburg works of the Westinghouse Machine Company, has been appointed manager of works, vice William A. Bole, resigned.

Trade Catalogs.

Receipt is noted for the following circulars and catalogs:

The Brunn-Lowener System for Softening Water. Pp. 23; illustrated; paper, 6 by 9½ in.

A. W. Harris Oil Company, Providence, R. I. Catalog, Petroleum Lubricating Oil. Pp. 32, illustrated. Paper, 5x8 in.

Broderick & Bascom Co., St. Louis, Mo. The Yellow Strand. Pp. 12; illustrated; paper, 7 by 10 in. December, 1905.

Allis-Chalmers Company, Milwaukee, Wis., Bulletin No. 1203. Allis Roller Mills. Pp. 36; illustrated; paper, 8 by 10½ in. December, 1905.

Crocker-Wheeler Company, Ampere, N. J. Bulletin No. 63. Direct Current Type Generators. Pp. 12; paper, 7½ by 10 in. January, 1906.

Niles-Bement-Pond Company, 111 Broadway, New York City. Catalog No. 11, Progress Reporter; Pp. 31, illustrated; paper, 9 by 12 in. April, 1906.

Construction News.

Bisbee, Arizona—The Shattuck-Arizona Mining Company proposes to erect a smelter. Byron Pattison, Bisbee, Arizona, is superintendent.

Georgetown, Colorado—The Trans-Continental Mining Company proposes to put up new machinery. George Vidler, Georgetown, Colo., is manager.

Lafayette, Colorado—The Northern Colorado Power Company proposes to build a large power plant. Denver and Boulder parties are interested.

Gilpin, Colorado—The Gettysburg Mining and Milling Company will erect a concentrating mill on its property. A. M. Willard, Gilpin, Colo., is the manager.

Zacualpan, Mexico—The United States & Mexico Mining Company proposes to erect a 25-stamp mill at its Coronas mine. H. L. Eisenhart, Mexico City, is president and manager.

Pine Grove, Utah—The Pine Grove Mining Company is considering the question of putting up a mill on its property in Beaver county, Utah. L. S. Hills, Desert National Bank, Salt Lake City, is the principal owner.

Special Correspondence.

San Francisco. April 17.

[This letter was written and mailed the day before the terrible catastrophe at San Francisco—EDITOR.]

Although Santa Barbara county has come more rapidly to the front than any other in the State in the matter of new productive oil wells within the past two years, all the enterprises started are not successful. The Todos Santos Oil Company, after sinking 4300 ft. has been compelled to abandon the enterprise, no oil having been found even at that depth. The land has been under lease from Pedro Zabata, but is now given up. Some $50.-000 was sunk in the enterprise, with no results.

The Independent Oil Producers' agency of Kern county is fighting the Associated Oil Companies. The oil shipments out of the county are now about 75,000 barrels per day, but stocks are running low, and the production much less than usual. The contract which the agency held fixing the price of oil at 18c. per barrel expired April 11, and it is understood that no new contract has been entered into.

The miners of Modoc county have formed a mining district which includes the territory from a point on the Nevada State line one mile north of the township line, between townships 44 and 45, thence along the line westerly to the county road on the east side of Goose Lake Valley, thence north to the California-Oregon State line and east to the Nevada State line. This territory includes the new gold mines on Mount Bidwell. The name adopted is the Hoag district. This month a strike has been made in the mountains near Lake City, 16 miles south of the Mount Bidwell mining district. The new find proves to be a ledge 5 ft. wide of gold bearing ore which assays well at the surface. Men will be put to work at once to develop the property. This new find gives weight to the theory that the range of mountains which forms the western boundary of Surprise Valley carries gold values.

The litigation connected with the old Zentgraf mine in El Dorado county, owned by the Montauk Consolidated Mining Company, has finally been settled by the Court of Appeals. After the Montauk Company had been working the property for a year it ran into debt for labor and supplies more than $20,000. In April, 1901, William Goodwin received a deed from the company and agreed to pay the debts. A petition was filed in which it was alleged that Goodwin had made certain preferences, and it was asked that the company might be adjudged insolvent under the laws of California. The Superior Court of El Dorado county ordered that the deed to Goodwin should be canceled. Goodwin appealed, but the Court of Appeals has now affirmed the judgment of the lower court. The property is given to

United States Senator Nixon, of Nevada, as assignee in insolvency, to settle with the creditors.

The old Mount Gaines mine in Mariposa county, at one time a large producer, was some years ago closed down by its owner George Crocker, as unprofitable. The Mount Gaines Consolidated Mining Company, F. C. Longhe, manager, bought the mine and a few months ago completed its unwatering. Since the first of the year the mine has been operated steadily, crushing about 30 tons of ore daily with a Huntington mill. An average of 50 men is employed.

It was supposed that when the smelter trust decided to erect a smelter at San Bruno point, on San Francisco bay, they would give up the idea of building a smelting plant on the recently acquired Balaklala copper mine at Kennett, in Shasta county. It was thought that the Balaklala ores would be shipped to the San Bruno smelter, as the Mountain Copper Company's ores are shipped out of the county to the smelter above Martinez. Such, in fact was part of the plan at that time, but these plans have been considerably revised, to the advantage of Shasta county. A large modern smelter plant with an ultimate capacity approaching 2000 tons daily, is to be erected within a distance of several miles of the mine itself, probably at some point on the Southern Pacific Railway. A low-grade matte is to be produced, and the product shipped to the smelter on the bay. The mine and local smelter are to be connected by an aërial ropeway.

Salt Lake City. April 20.

Several Utah mining companies declared dividends during the present week. The Grand Central for $15,000; Victoria, $12.500; Godiva, $50,000, all of the Tintic district. The Utah, of Fish Springs, also responded with one for $1,000.

E. W. Clark, of Ophir, Utah, manager of the Overland mine at Sunshine, has announced that the mill at this property will be started in about 60 days. The new shaft, the sinking of which was made necessary through the caving of the old incline, cut the orebody at 860 ft. depth. It is now down over 900 ft. and has penetrated the ore for about 60 ft. The ore carries gold values averaging about $5.50 to the ton.

The Mammoth mine in the Tintic district has been undergoing examination by engineers in the employ of the American Smelting and Refining Company. Recent development at 2160 ft. depth has disclosed a large body of high-grade copper ore. About 100 tons a day is being shipped to the smelters. The dividend posted this week is the first one announced by the directors in several years, and will make an even $2,000,000 disbursed since the incorporation of the company.

The Selma Consolidated Mining Company, with $200,00 stock of the par value of 20 cents, has been organized to operate the Selma group of claims in the North Tintic mining district. Lars C. Peterson, Eureka, Utah, is president.

Two new companies, to operate at Alta, have been launched. The Columbus Extension, with 300,000 shares of the par value of $5, will develop property adjoining the Columbus Consolidated and Flagstaff, having acquired 200 acres. The company is a strong one, and will begin business with all the capital and with, it is said, $100,000 in the treasury. Tony Jacobson, Manager of the Columbus Consolidated, is president; A. D. Jacobson, vice-president; S. A. Whitney, secretary and treasurer; all of Salt Lake; C. K. McCornick and T. M. T. Rayborg, of New York, completing the board. The Secret Mining Company is the other, and will have a capital of 300,000 shares of $1 each. This company has acquired claims comprising 80 acres near Albion mine. The officers are: President, W. M. Minor, New York; vice-president, Charles P. Minor, Kansas City; secretary, Harry S. Harper, Salt Lake City.

The Tintic Mining and Development Company, out of its Yampa copper mine at Bingham, is treating about 700 tons per day. Additional equipment, which will be placed in commission in about 30 days, will double the capacity of the plant. The expense of construction has been made out of the mine and the treasury contains a balance of a little more than $100,000. The Yampa mine is situated near the Utah Consolidated and Utah-Apex mines.

The management of the Utah Copper Company has let a contract to the Minneapolis Steel Machinery Company for structural steel for the second section of the concentrator at Garfield, the first section of which is now under construction. The order calls for about 2,000 tons of material for delivery in August and September. This will bring the capacity of the plant up to 6,000 tons of ore per day.

The Boston Consolidated Mining Company has let a contract for 1000 bbl. of cement to be used in the foundations of its new 5,000-ton mill to be built at Garfield.

Announcement has been made that the washouts on the main line of the San Pedro, Los Angeles & Salt Lake Railroad in Nevada and which have had the road out of through business for about three weeks, will be repaired by the first of next week.

Recent discoveries near Alpine, Utah county, have created quite a little attention in Provo and other Utah county towns. Some good gold ledges have been found.

The ore and bullion settlements reported by Salt Lake banks last week amounted to a total of $428,900.

Final payments have been made on the properties now being developed by the Consolidated Flagstaff Mining Company at Alta.

It is expected that the construction of the Continental Railway, to be built between Bingham Junction and Wasatch, will begin in May. The line will mean a material lessening in ore transportation costs. H. M. Crowther, Dooly block, Salt Lake, is manager of the road, as well as of the Continental-Alta mine.

Recent washouts in southwestern Utah practically destroyed about 15 out of the 40 miles of road built by the Utah & Eastern Copper Company last year between its mines and Acoma, a station on the San Pedro, Los Angeles & Salt Lake railroad.

At a meeting of the shareholders of the Montgomery Mountain Mining and Milling Company, Samuel Newhouse, D. H. Peery, C. C. Parsons and C. E. Loose were elected directors. Mr. Newhouse will be president. The company's property is at Rhyolite, Nevada.

Butte. April 20.

Negotiations are pending here for the organization of a company with a capitalization of $20,000,000 to work undeveloped mining claims in this district. The project was hatched during the recent visit of Wm. A. Paine and other capitalists to this city. Agents of the proposed corporation have secured options on some valuable ground, and are trying to get hold of the Moulton Company's property, owned principally by W. A. Clark, and induce one or two of the new companies that have valuable ground to merge their interests in the enterprise.

Original Consolidated, a Clark asset, is operating only one blast furnace in its reduction plant. Its copper output this month will fall far short of that of last month; it will probably be 1,000,000 lb., or less.

Raven Copper is hoisting more than 100 tons of ore daily, and has between 150,000 and 200,000 in sight in the workings of its mines. It has opened up the veins of the 1500-ft. level in good shape during the last month. Its shipments this week will aggregate about 1000 tons.

Amalgamated is shipping nearly 7000 tons of ore a day to the Washoe and 3500 tons to Great Falls, but it is still handling all North Butte ore and the larger portion of the output of the Clark mines. East Butte is shipping fully 50 tons a day. Butte Coalition is extracting 1500 tons a day, and La France Copper 250 tons, nearly 100 tons of which is zinkiferous and goes to the Montana Zinc Company. Total shipments daily aggregate about 12,500 tons.

Some of the companies organized within the last six months are doing good work. Butte & London—the name of which has been changed to Butte & London Copper Development Company at the request of the three directors of the Venture Company, who were elected directors of the

Butte & London—reached bedrock at a depth of 240 ft. Butte Copper Exploration is down 460 ft. Lewisohn General Development is still pumping water, but has increased the power of its surface equipment. Butte & Bacorn is down 105 ft. and is equipping its main shaft with a substantial head frame and hoisting machinery good for 1000 ft. Reins Copper finished sinking today and will begin cutting a station on the 1200 level.

Butte Coalition is mining between 1400 and 1500 tons daily and treating it in the old United Copper plant. This company is now crosscutting from the 1800-ft. level of the Corra mine to the east claims of the Alice Company in order to determine the contents of veins in the latter. The face of the opening is nearing the Valdemere, in which copper ore was discovered years ago.

Paradise, Ariz. April 20.

S. S. Badger, of Paradise, has bonded the Hall or Morning Star group, and with F. B. Dorr, Douglas, Arizona, has successfully organized the Paradise Development Company with $200,000 capital, 20,000 shares, with the following directorate: E. J. Huxtable, president; J. L. Andrews, vice-president; F. B. Dorr, secretary and treasurer; S. S. Badger, consulting engineer and R. O. Hall. The property taken over by the development company consists of 10 claims just west of the Cochise Consolidated Copper Company, in the Chiricahua mountains. The greater part of the development has been on the Morning Star claim in the center of the group, and consists of an incline shaft sunk on the hanging wall, and a 90-ft. incline shaft on the foot wall, showing that the contact carries the ore between the two shafts about 40 ft. The ore carries copper, silver, and gold.

The Savage Gold and Copper Company reports uncovering two new blind ledges in crosscutting from the west drift 100 ft. below the main adit tunnel. Mr. Lewandowski, the manager, is working a force of 25 men and has sent out for 20 more. The smelter building is under way.

The Cochise Consolidated Copper Company has put the new 100-ton mill in commission and will begin regular shipments to the El Paso smelter this month.

Dick Larue will ship a carload of high-grade zinc ore this month and is pushing his development work.

Alexander, Davis & Stone have a force of men at work on the Doran & Gallagher group which they recently bonded.

The Bernoudy & Wright strike continues to be the chief talk of the camp.

Leadville. April 20.

The sinking of the Mammoth shaft, Big Evans gulch, still continues through ore, 20 ft. of the solid material having been penetrated and the end is not yet in sight. The values in the body hold up to 135 oz. of silver, and 30 per cent. lead. It is the most important strike made in this district since the opening of Little Jonny mine in 1902, and it opens a large district of virgin territory for future development. Already several eastern parties are interesting themselves in ground in the vicinity, and it is stated on good authority that by July five new shafts will be going down in the neighborhood. Some trouble is still being experienced with dolomite sand that keeps coming in and clogging the valves of the pumps.

The Tucson shaft of the Iron Silver Mining Company, on the eastern crest of Iron hill, is now down in the neighborhood of 925 ft., and for the last 10 ft. has been in ore. The orebody opened by the diamond drill showed a thickness of 185 ft., and it is likely that the shaft will develop the same sized ore-shoot. This is the extension of the Moyer shoot to the east, and the samples from the drill cores showed heavy values in zinc. The shaft will be sunk beneath the orebody. Little trouble is being experienced from water, as the shaft has drained the section in its immediate neighborhood.

On account of the terrible condition of the roads leading to all of the mines in the outlying districts, not connected by rail, the output for the month will be slightly curtailed, as it is impossible to haul a pound of ore. The mines on Rock hill are for the time being shut down, and nothing but development work is being done. By next week, if the weather continues favorable, the mines will resume shipping.

The condition at the Nil Desperandum on Rock hill keeps the management guessing. For several months past streaks of ore have been followed by drift, winze and upraises, and yet the main ore-shoot has not been opened. The whole of the lower workings are heavily mineralized, and last week several streaks of rich carbonate ore were found and are being followed. The result is being watched with interest.

The Admiral Prindle shaft, lower Rock hill, is 670 ft. deep, and has entered the solid formation. A diamond drill is being installed at the bottom of the shaft, and prospecting in the lower zone will be carried on by this method. The Thompson shaft is 600 ft. deep, and when it enters the solid formation the diamond drill will be put to work.

Recent investigation by a reliable mine manager places the value of the ore taken from Fryer hill at $35,000,000, all of which has come from a small acreage and from the upper workings. Several parties interested in the hill are trying to raise sufficient capital to sink several shafts to the second contact, contending that valuable sulphide deposits will be found there. Their theory is borne out by the recent strike in the Mammoth the rich ore-shoot being opened in the lower zone, and the trend of the shoot comes from the direction of Fryer hill. For a number of years prospecting has been carried on in the foothills of the Park range in the neighborhood of Hartzel in South Park, but nothing of value was ever opened until last fall. At that time two or three prospectors opened veins running in width from 1 to 4 ft., carrying values in gold from $5 to $20 per ton. This was the result of cyanide tests. M. Hewitt, president of the Chicago & Northwestern railroad, became interested in the discovery, and has kept a force of men at work during the winter, and has had a number of cyanide tests made on the ore; he is so satisfied with the results that a mill of this character will be erected at the claims this summer, and all of the ore thoroughly tested. Several parties from Colorado Springs, Salida and Buena Vista have visited the strike and were so impressed with it that they staked off claims and are at work on them. The section can be reached by the Colorado Midland railway, which is 8 miles south of Hartzel.

The Rawlins mill of the Boston-Arizona Mining and Milling Company started during the week, and is running on ore from the Fanny Rawlins. The capacity of the mill is 50 tons daily. It is located near the old Harrison reduction works.

As the snow disappears from the outlying districts, prospectors are going out to their claims, and this is especially noticed in Big and Little English gulches, where some good ore recently has been opened in several shafts. More work will be done here this summer than for many years, and the results will no doubt be satisfactory as the immense porphyry that traverses the section will be largely worked.

Joplin, Mo. April 21.

The M. I. & O. Mining Company, of Joplin, has filed articles of incorporation with a capital stock of $40,000. The stockholders are John F. Wise, Del. C. Wise, Haywood Scott, Ward Frey, W. H. Volmer, Samuel Thompson, and C. C. Winkler.

Barber Gibson, Roy Hilburn and others, of Webb City, who recently took a lease on 20 acres of the Luke land, situated south of Webb City, have encountered a fine run of ore 22 ft. in thickness in the first drill hole. They will sink two more.

The Old Monarch mining land, situated east of Jackson station on the electric line between Joplin and Galena, has been leased out for mining purposes.

The Sunrise Mining Company, operating on the J. W. Allen land at Spring City, is just now breaking into the orebody and taking out both lead and zinc.

Much interest is being shown at Stotts City in a mining way at the present time. It is reported that a number of the leading citizens will subscribe a fund for the purpose of doing about 1000 ft. of drilling near the city.

Greninger, Lowe & Co., operating on the Burch land southeast of Duenweg, this week encountered a run of lead ore in a drill hole at 19 ft. and extended down to 31 ft. They will sink the hole to the 175-ft. level.

Ben Hatcher, George Ball and Wm. Gunning, of Webb City, owners of a 30-acre lease of the Collins land at Duenweg, have let a contract for 3000 ft. of drilling. Their lease adjoins the Price land on which the Mattes Bros. of Joplin, have opened up a mine.

The LeRoy Mining Company, composed of A. D. Hatten and T. F. Coyne, of Webb City, and a number of eastern parties, has let a contract for the erection of a 200-ton concentrating plant on its lease on the Hamilton Zinc Company's land north of Joplin.

Platteville, Wis. April 17.

The Industrial Mining, Manufacturing and Development Company has been organized with the intention of taking up all branches of the mining industry, such as mining, prospecting and developing. It is the intention of the promoters to pay attention to mining in southwest Wisconsin in general, and Grant county in particular. The company is capitalized for $1,000,000.

At a directors' meeting of the Gritty Six it was decided to dispose of some more treasury stock, with which it is intended to clean up all outstanding indebtedness. There is now piled up in the bins between 200 and 300 tons of ore awaiting treatment.

Between the bad roads and scarcity of coal, the mines are beginning to suffer. The Dall mine at Meekers Grove camp has been shut down for several weeks. The St. Rose has the bins full and will probably build new ones to store the surplus.

The new vein of zinc and lead reported some time ago at the Morrison Mining and Development Company's mine, Shullsburg camp, continues to increase in richness. The ground lying above and below the sheet of ore is heavily impregnated with pebble ore, consequently all the rock broken contains more or less ore and will pay to run through the mill.

One of the largest companies to come into the field recently is the Big Tom Syndicate, composed chiefly of Rockford, Ill., men. They are operating in the vicinity of Benton, Galena and Hazel Green camps and have five drills at work prospecting.

The recent development work at the Little Dad, near Hazel Green camp, shows a 4-in. vein of Jack below the oil rock. This property is supposed to be on the same range as the Kennedy and Hoskin. A new lift pump has just been installed.

The Homesite Mining Company at Mineral Point is installing a hoisting outfit, under the management of Otto Schicker, Janesville. Capital is behind the proposition.

The DeSoto Lead and Zinc Company expects to start operation on the Day farm, not far from the Galena camp.

Hartshorne, Ind. Ter. April 18.

The meeting of the Southwestern Instertate Coal Operators' Association, embracing Kansas, Missouri, Arkansas, Indian Territory, and Texas, at the Coates House, Kansas City, April 11, was the largest as well as the most harmonious meeting ever held and developed the fact that outside of Texas the members are good "stand-patters."

The meeting was unanimous in approving the action of President W. C. Perry and the scale committee at the Indianapolis conference, and in the determination to adhere to the position of resisting the unjust and inconsistent demands of the miners.

Texas was not represented, as their principle operators, the Strawn Coal Company, and the Texas & Pacific Coal Campany has acceded to the miners' demand, and signed the scales presented.

These operators, as well as the very few others in different sections who took the same action, were expelled from the association.

In the Indian Territory the only backsliders among the operators proved to be three very small ones near McAlester, with a total output of less than 150 tons daily. Only one of them was a member of the association.

The Kansas City meeting re-affirmed the request to President Roosevelt to appoint a commission to investigate the whole situation and make a scale. The request is signed by every member of the association.

The meeting also adopted resolutions declaring their right to operate their properties without interference from the United Mine Workers of America, and their right to operate on the open-shop basis.

Duluth. **April 21.**

The Mahoning Ore and Steel Company during the past winter has spent about $100,000 in developing a new approach. This is at the west end of the mine, and reverses the condition of things at the property. The mine has been shipping for two weeks and more, and is now on its regular summer gait. Its production for 1906 will be in the neighborhood of 1,000,000 tons, the amount it has sent forward yearly for a number of seasons. The company is now exploring the 1½ miles of ground between its mine and the limits of Hibbing, and with every expectation of getting enormous bodies of ore therein. It owns a stretch of land 2 miles long and ¼ mile wide, near the westerly end of which its present mine is situated. There is every reason to expect that much of the remainder of the tract is ore. It also owns a large tract south of the present mine, and this is well known to contain ore. No attempt has been made to open this for mining, though such action was under consideration a few years ago. Certain other tracts west of the mine, all in 57-21, have been owned by the company for many years, selections made during the beginning of ore discoveries on the westerly Mesabi, and there is much ore in these lands. Taken all in all the probable tonnage of this company is something really stupendous. Fifty per cent. of its stock is owned by the Cambria Steel Company, and the rest in smaller blocks by various interests, including the United States Steel Corporation and the Republic Iron and Steel Company.

Mine labor is very scarce on all Lake Superior iron ranges, and the companies are considerably disturbed over their opportunities for adding to their forces when desired. There is so much outside work in the Northwest this year—railway building, lumbering, general construction and the like—that there is not enough labor to go around. The far western mining fields are very active, and they have been in the habit of drawing on Lake Superior for additional men whenever needed. Then there are not less than 2,500 men employed just now in churn and diamond drilling in the Lake Superior field, mostly on the Mesabi range.

It is said that 400 drills are working on the Mesabi alone. These are employed by exploring syndicates, contractors and mining companies, the latter mostly for developing ore deposits that have been discovered but not thoroughly explored, but are to be opened soon. And for this reason they are to be scientifically gone over. On the older Lake ranges a larger number of diamond drills are busy than in past years, mostly by contractors; and in the Cuyuna and Baraboo regions, there are several more, say 35 on the Cuyuna alone.

The Western Federation of Labor has been able to organize at a few points on the Mesabi, and is trying to get a foothold in other Lake districts, but with poor success so far. The Mesabi is not a good field for such an organization, for it is possible to split up labor there so that disunion will likely become apparent in its ranks quite quickly. The Mesabi towns in which it has organized are not those in which mining is largely carried on.

Probable production by the Republic Iron and Steel Company for the year will amount to nearly double that of 1905, or 600,000 tons. Most of this will come from the Mesabi range, and the company's largest producer will be the Kinney, which has been stripped for open-pit mining. This company will open its head mining office at Duluth in a few days, with C. T. Fairbairn in charge.

Scranton. April 23.

The surprising feature of the "cessation" in the anthracite mines, this week, has been the number of men who have returned to work and walk the streets openly to and from the collieries. This is particularly true in the Northern basin and is in marked contrast to the conditions which prevailed during the strikes of 1900 and 1902. There is not a day that there are not acquisitions to the number of men at work, although the operators are waiting for the declaration of a strike to inaugurate the real struggle. As an instance of the break in the union ranks it can be stated, on official authority, that at the Brisbin mine of the Lackawanna the regular output will be reached on April 25. The mine workings are now well supplied, but every chamber will be manned in a few days. Some of the men reside in the vicinity of the colliery and walk from their homes, dinner pails in hand, defiant of any molestation. No illegal act has occurred as yet, for the reason that the feeling does not run high. The bulk of the men are divided hopelessly on the wisdom of the cessation order. Many state openly that they see no necessity for it, and that it cannot result in any gain to the union. Others argue publicly that the offer made by the operators should have been accepted and the loss of the three weeks avoided. There are many who ask that the earnings of the company hands be increased, and all the men would willingly return to work upon the offer of the operators.

All the miners, however, are in the dark; but their restlessness has caused the leaders to make a tour of the locals, where addresses have been delivered for the purpose of keeping the men in line. The three district presidents have been busily engaged in this work, but there has been no special enthusiasm at these meetings. Hope is pinned to the joint meeting of the executive board in Wilkes-Barre on Wednesday. If something of a definite nature is not accomplished that day there will be grievous disappointment and the dissatisfaction will increase very rapidly.

If another convention of the anthracite districts is called, there will be a strong demand for a secret ballot to instruct the delegates. The demand will be made by the men who are in favor of moderate measures, or, interpreted, a return to work, by accepting the offer of the operators. These men contend that the more aggressive or radical men in the locals exert an undue influence upon others who vote against their better judgment, owing to the bluster made in the discussions. With a secret ballot on the matters to be determined at the convention it is believed that the delegates would receive instructions to order a return to work, and a reacceptance of the award of the Strike Commission.

In the meantime the operators are rushing forward with their plans for fighting the union. Two hundred strike breakers arrived a few days ago at Lansford and were sent to No. 2 colliery of the Lehigh Coal and Navigation Company. Each man was given clothing and shoes, with a trunk filled with wearing apparel. A commissary was also established behind the stockade and quarters erected in which the men will live. Men who are living in the company houses, and who refuse to work, have been ordered to vacate, so that men now working in the mine may occupy the houses. In the Northern basin the companies have appointed their purchasing agents as follows: Lackawanna, C. E. Tobey; Delaware & Hudson, Thomas Shotton; Erie, Frederick Mason. They have conferred with wholesale grocery firms and have closed arrangements for supplying provisions for the men at work.

An effort was made in Philadelphia this week to organize the business men of the anthracite region to take concerted action against the threatened strike. The business men are opposed to a one-year agreement and will ask that any decision arrived at shall be binding for a long term of years

The Philadelphia & Reading Company is successfully operating the big washery at Middle Creek, near Tremont, turning out daily 1500 tons. It is expected that this will be increased. The company is also opening all the washeries as quickly as possible, and the officials state that there is no lack of men for the work.

No. 5 breaker of the Erie, at Dunmore, has been running for two weeks with an average output of 500 tons per day. Work has been commenced at Plymouth No. 2 colliery of the Delaware & Hudson Company, where a train load of imported men have been installed and are at work. They are accommodated in 20 freight cars, which have been fitted up with living, cooking and sleeping quarters.

The only trouble with men at work, recorded so far, occurred at the Hazleton shaft of the Lehigh Valley. A crowd of men on their way to work were stopped by some alleged pickets, and one, it is claimed, was assaulted. District President Dettery went to the scene to investigate and declared that no unon men were present.

The Beaver Meadow washery has been completed and is ready for operation. The McClelland Coal Company will erect a new washery at Beaver Meadow to work the bank surrounding the old Evans colliery.

A few days ago a notice was posted by the United Mine Workers announcing a meeting of the men employed at the Bellevue colliery of the Lackawanna Company, whom it was desired to keep in line. Among those who accepted the invitation to attend was Col. R. A. Phillips, general superintendent of the Coal Department. His appearance at the meeting caused some consternation, but a seat was obligingly offered him and he remained to hear the speeches of District President Nichols and others. Nichols playfully alluded to his presence at the meeting, while his name was received with cheers.

Thomas Stapleton, a veteran miner of Tamaqua, has invented a device to take the place of the safety dog on the mine cages. The model shows the regulation mine cage, there being a series of grooves on the planes along the sides. The moment the cable breaks, an arrangement of rods, extending along the top and sides, throws out two heavy supports on the bottom of the cage, which slip into the grooves and hold the cage. A series of tests has been made and it is claimed that they were entirely satisfactory.

Toronto, Ont. April 21.

S. Scott, sanitary inspector of the Cobalt district, reports to the Provincial Board of Health that, despite defective sanitary arrangements, the health of the camp is good and contagious diseases almost entirely absent. Mr. Scott visited all the mining and prospecting camps and gave full instructions as to sanitation. Instructions have been issued by the department that only boiled water should be used for drinking. The regular removal and dumping of refuse and garbage is being arranged for by the municipal authorities. The town of Cobalt has now 700 houses and a population of about 3000, as nearly as can be estimated. Great activity prevails in house building, and a large number of hotels and boarding houses are beng hastily run up. Tents are also largely in use. Although snow has not yet disappeared, hundreds of prospectors are at work in the woods. Some important finds in Lorraine township, to the east of Coleman, have attracted many in that direction.

The Glendenning or University mine, owned by George Glendenning, W. J. Blair and H. L. Kerr, students of the Toronto School of Practical Science, from which the first shipment of ore was made in November last, has produced in all about $100,000 of ore. The mine has now an up-to-date plant, including a Rand drill, a 20-h.p. boiler and steam hoist. The shaft has reached a depth of 80 ft. On the 70-ft. level two drifts are being tunneled, one having gone 90 and the other 50 ft. Continual work is being carried on in the tunnels, the vein averaging 15 in. in width. The plan is followed of working overhead, timber being employed where necessary. The waste rock is used to raise the level of the drift, which avoids the necessity of hoisting it along with the ore, as would have to be done if the vein were followed downward. Three veins have been located on this property, but so far the work has been practically done on one vein.

Numerous smelter propositions have

been made, but the question does not now excite much interest in view of the terms guaranteed by the company now establishing a refinery in Hamilton, which will treat the ore for 95 per cent. of its silver value, allowing for the nickel and cobalt contents. J. H. Brown, metallurgist of Salt Lake City, at present in Cobalt, states that he and those associated with him are prepared to spend from $300,000 to $400,000 in establishing a smelter, provided they can be assured by the mine owners that they will be given the work. Mr. Brown asserts that by his process any ore worth $20 per ton or more can be successfully treated at a charge of about $10 per ton, so that much of the ore which is now wasted could be made a source of profit.

The McKinley & Darragh mine has been taken over by F. Chapin and his associates, Messrs. Sibley, Thompson and Finucane of Rochester, N. Y., who this week made an inspection of their purchase. It is probable that stock in the mine will be offered to the public.

The mining bill now before the Ontario Legislature, in addition to the provisions already noted, provides for the appointment of a mining commissioner, whose duty will be the settlement of mining disputes. At present such cases are heard by the Minister of the Department and latterly have occupied much of his time. The commissioner will hear all appeals from the decision of the mining recorders of the various divisions and is empowered to visit the localities, where necessary, and obtain first-hand knowledge of conditions in connection with disputes.

The Provincial Government of Ontario has decided on the appointment of a provincial assayer, who will be an official of the Bureau of Mining.

Neil Gilmour, Indian agent at Norway House, reports to the Indian Department, Ottawa, that the country around the upper waters of Lake Winnipeg shows indications of mineral wealth. Two prospectors have discovered promising silver veins, the formation being similar to that of the Cobalt region.

A strike of natural gas was recently made on the property of T. Hickey, near Wainfleet, Welland county, Ont., which was capped to suppress the flow; but a few days since it blew up, making a large hole in the ground. It is now again under control.

Victoria, B. C. April 12.

Cariboo—John B. Hobson, for the past ten or twelve years, manager of the Consolidated Cariboo Hydraulic Mining Company, operating at Bullion, in the Cariboo district of British Columbia, has returned to the Province after having spent some time in New York in connection with the acquirement by capitalists of that city of the Consolidated Cariboo property. He will shortly proceed to Bullion for the purpose of putting in hand the work of largely extending the water-supply system so as to make provision for an abundance of water for gravel-washing uses. The total value of gold recovered from this hydraulic mine during 12 years, ending June, 1905, was $1,233,936. During several years, 1902-5, the water supply has been insufficient to admit of washing without interruption throughout the respective seasons, consequently the recovery of gold has not been as large as will be the case when an adequate water supply shall have been provided.

East Kootenay—The output of coal at the Crow's Nest Pass Coal Company's collieries during March was the largest yet reached in any one month, having been 4970 tons in excess of that of last January, the highest to that date. The production at the company's several collieries was as follows: Coal Creek Colliery, 43,701 tons; Michel, 29,667; Carbonado, 7904; total, 81,273 tons. The production of coke in March amounted to 25,452 tons, which though not a record, was a satisfactory output.

From the lately issued report of the directors of the Consolidated Mining and Smelting Company, of Canada, Ltd., it is learned that since Sept. 30, 1904, there have been mined at the St. Eugene mine, now owned by this company, 151,373 tons of ore, which yielded 32,650 tons of concentrates and 1734 tons of crude ore, or a total shipping product of 34,384 tons, containing 1,029,820 oz. of silver, and and 40,462,141 lb. of lead. The total gross value of this production was $1,820,011, or at the rate of $52.93 per ton. After deducting all freight, smelting, refining and marketing charges, the net amount received by the company, including the bounty on lead produced in Canada allowed by the Dominion, was $1,232,893, or at the rate of $35.85 per ton. On Jan. 1, 1906, it was estimated that the ore available in the mine amounted to 150,000 tons, which will produce about 33,000 tons of concentrates and picked shipping ore. About 15,000 tons of ore are being mined monthly, this yielding some 2700 tons per month of concentrates and crude shipping ore, averaging $60 per ton gross value. A new ore-shoot has been found in what will be known as the 1300-ft. level, which may yield a considerable tonnage. A winze driven from the 1900-ft. level encountered what appeared to be a good body of ore, but the extent of this cannot be determined for several months.

Boundary—The recent joint visit of officials of the British Columbia Copper Company, of New York, and the Denoro Mines, Ltd., of Rossland, B. C., to the latter company's Oro Denoro mine situated in Summit camp, adjoining the Emma mine, which the British Columbia Copper Company is operating, has led to the conclusion that the latter company has an option on the Oro Denoro on which large orebodies are known to occur, and which has, during the last three years, shipped about 40,000 tons of ore to district smelters. Prospecting with the diamond drill is in progress. The mine is favorably situated in respect to transportation, since the lines of both the Canadian Pacific and Great Northern railways cross the property.

Nelson—The Nelson *Daily News*, the leading newspaper published in the interior of British Columbia, takes a favorable view of the future of the mining industry of the Kootenay and Yale districts, which include Boundary, Rossland, Nelson, Ymir, Slocan, Lardeau and East Kootenay mining camps. It makes the following comment: "The first quarter of 1906 shows the total of 429,072 tons of ore produced in the districts of Kootenay and Yale, which is at the rate of 1,700,000 tons per year. That this rate will be maintained is more than likely, and indeed the probabilities at this time in the year seem to indicate that a total tonnage of 2,000,000 tons will nearly be reached. At present there are 76 mines shipping over the whole of these districts." Incidentally, it may be mentioned that last year's total tonage was rather more than 1,700,000 tons for the whole Province, the great bulk of the ore having been produced in the districts above mentioned.

Mexico. April 20.

Considerable interest is being manifested in London in Mexican mines and there bids fair to be a regular Mexcan boom. This is in a large part due to the excellent showing now being made by the Esperanza properties in El Oro and the promising condition of the New El Oro Mining and Railway Company. This company was registered with £500.000 capital by Clarke Rawlings & Co., London, last December, to take over the Somera No. 1 and other outlying properties of El Oro. Parral also is attracting attention by reason of the returns from Pedro Alvarado's bonanza, the Palmillo mine, as well as the recent purchase of the Parral & Durango Railroad and the holdings of the Hidalgo Mining Company by the Parral Railway and Mining Corporation. This latter company is, I think, that which has just been registered by Ashurst, Morris & Co, with £500,000 capital, to "acquire, equip, work and maintain railways, tramways, telegraph and telephone lines, etc., in Mexico and elsewhere." The direcors for the first year are C. C. Macrae, president Railway Debenture and General Trust Company; Earl Denbigh, president San Francisco del Oro Mining Company (London and Parral); General de la Poer Beresford, director Mysore Gold Mining Company; C. Bill, and Sir Thomas Holdrich.

It is said that T. H. Deitz is in Mexico.

in the interest of the Norddeutsche Raffinerie of Hamburg, Germany, for the purpose of obtaining data on the bullion production of Guanajuato, El Oro and other camps in Mexico. The object is to establish a gold and silver refinery in Mexico City and treating there what is now being sent to Germany. Such a plant would be in direct competition with that already established in the City of Mexico by the National Metal Company, but the contracts held by this latter company with most of the largest producers of gold and silver bullion do not leave much as a basis on which to found another refining plant. It is doubtful whether the German company will find it to its advantage to establish one in this country.

In the State of Mexico Los Arcos Mining and Smelting Company has blown in its new 150-ton lead-silver smelter. It also parts the lead bullion and ships the high-grade silver bullion to the National Metal Company in Mexico City. In the Zacualapan district a strike of rich ruby silver ore has been made in the Coronas mine of the United States & Mexico Mining Company, of which H. L. Eisenhart is president and general manager. A 25-stamp mill is to be erected on the property.

A concession has been obtained for an electric railroad from Toluca, the capital of the State of Mexico, to Zihuatanejo, on the Pacific coast, by Henkel Brothers. They now own and operate the roads from Toluca to San Juan de las Huertas and to Tenango, and have the surveys already made to Temascaltepec, Tejupilco and Cotzumala, passing through the rich gold and silver districts of Sultepec and Temascaltepec. These and the copper of the Balsas need only a railroad to boom them. Power will be obtained from Nevada de Toluca, where it is estimated 20,000 h.p. can be developed, and also from the falls of Maninaltenango and others on the Lerma river, tributaries of the Balsas.

London. April 16.

A few months ago I referred to the success of the Clitters United Mines, Ltd., in Cornwall, and a recent paper read before the Institution of Mining and Metallurgy dealt with the same subject. It will be remembered that at this mine, Ferdinand Dietzsch has been able to treat complex tin, copper and wolfram ores at a profit, after the mines had been abandoned by Cornish owners. This success has led Mr. Dietzsch's city friends to expand their interests in Cornwall, and a company called the Cornish Consolidated Tin Mines, Ltd., has been formed to undertake further enterprises. The name of the company is not quite descriptive of the nature of the business to be done, for its objects are really those of a finance and development company. The sum of £45,000 in cash has been subscribed as working capital chiefly by members of the Stock Exchange, headed by the Meyersteins. A number of properties are under examination and negotiation. Though Cornishment may resent being taught ore-dressing and metallurgy by comparative outsiders, yet they cannot do otherwise than welcome this proposed influx of capital.

The Linares Lead Mining Company is one of the oldest of English mining companies, having been formed as far back as 1852. The company owns mines and smelters at Linares in Spain and its operations have been continuously under the management of John Taylor & Sons. The capital is £45,000, and dividends amounting to over £500,000 have been distributed, besides considerable sums spent out of revenue on renewals and extensions. In 1900 the developments were far from promising and special efforts were made to explore the property thoroughly, and at the same time to reorganize the mining and ore dressing plant. William Frecheville examined the property on behalf of John Taylor & Sons, and made suggestions. He and Ernest R. Woakes, the resident manager, have placed the company once more on a sound footing and paying basis. During the second half of 1905 the income from lead and ore sold was £43,000 and the expenses £33,900, leaving a profit of £9200.

The half year commenced with a balance in hand of nearly £6000, which was undivided profit for the first half of the year, so that the divisible profit for the year 1905 was £15,000. Out of this £9750 has been distributed as dividend, and £4750 has been written off the development and plant accounts. The ore raised during the second half of 1905 was 13,737 tons, which on dressing yielded 1357 tons of first-class concentrate, and 165 tons of second-class concentrate. In addition, the ore raised by tributors and on leased workings yielded 671 tons of first-class and 434 tons of second-class concentrate.

Sydney. March 20.

The mining industry in New South Wales is fortunate in the attention that capitalists have recently given to it. In addition to the capital of £800,000 provided by the Commonwealth Oil Corporation, Limited, there is the re-construction of the company formerly known as the Smelting Company of Australia, Dapto. The amount is given as £350,000, and as arrangements have been made to secure regular supplies of ores from the Broken Hill mines, the difficulty which the former company experienced in securing a regular quantity of ore will thus be overcome. There is also the company with a capital of £350,000 formed to work the zinc residue on the Broken Hill field. This means that a sum of £1,500,000 has been subscribed during the past six months for ventures in this State, and the important developments at the principal mines warrant the opinion that this confidence is fully justified.

Johannesburg. March 22.

There was a big drop in the output for February, as it is a short month. The profits for the month also show a decrease. A few mines show a loss for the month, nothing very great, but large enough to be disagreeable. There are somes mines that have difficulty in making ends meet. These mines are principally in the western section of the Rand, where the gold contents are low, and the working conditions unfavorable to low working costs. The difference between a mine of the Central Rand, and some further west, is very marked. A mine in the Central Rand with wide reefs and few faults can be worked on a large scale for 19 to 20s. per ton. With a recovery value of 29s. per ton, these working costs mean a successful proposition. It is quite different in some mines of the West Rand, where the only payable reef is from 1 to 2 in. wide. With such a narrow reef, faulted country, and a great deal of timbering, no wonder some mines find it difficult to pay. With these conditions, under the most capable management, working costs come out at 28s. 6d. to 29s. 6d. per ton. Where the working costs are 29s. 6d., and the recovery value 29s., there is not much in it. One wonders at times how some of the mines can be made to pay at all.

The difficulty of comparing working conditions of one mine with another is well illustrated on the Rand. Only a few miles separate a mine of the Central Rand, where the most fortunate conditions prevail, from a struggling proposition further west; but as far as difference of working conditions is concerned, the mines might be hundreds of miles apart. Things on the Rand now are in the dumps as much as ever. In spite of the favorable returns from the industry, and the assured future under favorable conditions, people look ahead with apprehension. One of the most pressing and depressing problems is that of the unemployed. The Rand Aid Association has published a gloomy statement. The number of applications for employment has greatly increased during the past month. The applications include men of all trades and professions. The greatest difficulty prevails in finding any means of livelihood for them, and the difficulty becomes more acute every day. A large number of expert workmen are now out of employment, owing to the recent completion of many of the large buildings in the town, such as the Carlton Hotel, the Cullinan buildings, the Johannesburg Consolidated Investment building. New building ventures are now at a stand still. Commercial houses have dispensed with many of their employees.

General Mining News.

National Lead Company—At the annual meeting in New York, April 19, the board of directors was increased from 13 to 15, and Daniel Guggenheim and Murray Guggenheim were elected to the new positions. Edward Brush was elected a director to succeed W. H. Thompson, deceased. These three directors will represent the Guggenheim, United Lead Company, and American Smelting and Refining Company interests. Murray Guggenheim will become a member of the executive committee and the active representative of the new interests in the company.

Amalgamated Copper Company—At a meeting held in New York, April 19, the directors declared the regular quarterly dividend of 1½ per cent. and an extra dividend of ¼ per cent. Three months ago the dividend declared was 1½ per cent. In November last year 1¼ per cent. was declared, in August 1¼, in May 1, and in February 1, making the year's disbursement 4¼ per cent. In 1903 and 1904 the yearly dividends amounted to 2 per cent., in 1902 2½, in 1901 7½, in 1900, 8, and in 1899, 2 per cent.

CALIFORNIA.

CALAVERAS COUNTY.

San Andreas Gold Mining Company—This company has been reorganized and the principal place of business removed from Salt Lake City to San Andreas, local people now being in charge. The officers are: J. L. Henry, president; Will A. Dower, vice-president, and Frank Kippon, secretary. The company will now sink on the middle vein to 1800 ft. depth, and a modern hoist will be erected for that work. Stations will be cut at regular intervals and crosscuts run. The mine is at San Andreas.

Yellow Boy Mining Company—At the Red Gold mine of this company at Murphy, grading is going on for the new compressor to run the air drills for sinking the shaft deeper and running the crosscut to the Buckhorn vein. Electric power will be installed.

EL DORADO COUNTY.

Ida Mitchell—This mine, Placerville, is to be unwatered, to be examined with a view of deeper development.

Sebastopol—C. M. Judson is building a debris dam at this mine above Georgetown, preparatory to working the property.

INYO COUNTY.

Great Western Ore Purchasing Company—This company at Keeler, Frank C. Everett, manager, will have the 40-stamp mill completed this month and the smelter shortly afterward. The Union mine is being opened through the Buena Vista tunnel.

Coso Reduction Company—The men operating the new concentrating works at Darwin are trying to increase the water supply from Crystal Springs. The average value of the Defiance and Coso slag piles is said to be $4.50 per ton.

Southern Belle Mining Company—Superintendent Vandercook of this property has had to reduce the regular force of miners, as so many of the men have gone prospecting in the newer districts of the county. The shafts in the Bullion and New Year mines will each be put down to 500 ft depth.

MARIPOSA COUNTY.

Austin Group—This group of mines at Whitlock, after a shutdown of some months, will be started up again early in May.

NEVADA COUNTY.

Union Hill—The water having been taken out of the shaft of this mine, Grass Valley, Superintendent Frank Enzensperger, is now getting the mill in readiness for the ore he expects to stope out shortly.

Bullion Mining Company— This mine, Grass Valley, George Mainhart, superintendent, has been unwatered after great difficulty. About 700 gal. of water uer minute have to be handled from a depth of 1500 feet.

Pennsylvania Mining Company—This company at Grass Valley has had great trouble with excess of water, and a number of men have had to be laid off. Larger pumps have been ordered, and meantime a smaller force of men will be kept at work than heretofore.

Birchville—At this mine, Graniteville, the 700-ft. tunnel has been cleaned out and put in order and the shaft cleaned by a depth of 200 ft. As soon as the shaft is all cleaned out considerable development work will be done.

PLACER COUNTY.

Buckeye—At this mine, Forest Hill, W. G. Witter, president, and T. H. Rood, superintendent, 20 men are employed and rich gravel is being mined.

Eagle Bar—This mine at Forest Hill, has suspended operations for the present, throwing a number of men out of employment.

SAN DIEGO COUNTY.

Cuyamaca Company—The Cuyamaca ranch, aggregating 20,294 acres and including the old Stonewall mine, has been sold by Richard H. Stewart, trustee, to Daney & Lewis of New York, acting as agents for E. B. Tustin of that city. The sale at auction was in accordance with the deed of trust to Stewart by the Cuyamaca Company. The Stonewall was at one time a famous gold producer and was partly reopened a year or two ago.

SISKIYOU COUNTY.

Quigley Place—The Wm. Quigley place near Walker, on the Klamath river, has been sold to New York capitalists, who will now properly open the auriferous gravel deposits known to exist there.

Wilson Tract—Eastlick Brothers are opening up this tract with good success. There is plenty of water and two giants are kept in operation.

TUOLUMNE COUNTY.

Jumper Gold Syndicate—At this mine, Stent, Superintendent M. D. Kelly is preparing to sink below the 1456-ft. level. The shaft is not, however, in very good condition and the present hoisting works will doubtless have to be replaced by heavier machinery.

COLORADO.

LAS ANIMAS COUNTY.

One of the Colorado Fuel and Iron Company's collieries, situated about 40 miles west of Trinidad, was wrecked by an explosion on April 22. It is believed that about 30 lives were lost through it. Already 22 bodies have been recovered. Japanese and Italians were chiefly employed in the mine, but James E. Reed, the fire boss, is among the dead. The accident occurred near the entrance and resulted from a blown-out shot, exploding the coal-dust on the floor of the main entry. All the men at the working face, about 3700 ft. from the entrance, escaped without suffering any ill-effects.

SUMMIT COUNTY.

Hamilton Mine—This mine, with its mill and concentrating plant, has been leased by the owner, M. A. W. McFarland, the machinery manufacturer of Denver, to a party of local capitalists.

Briar Rose Mine—This property, situated on Peak 10 of the Ten-Mile Range, south of Breckenridge, will be actively worked this spring and summer. It was purchased last fall by the Southwestern Brokerage and Investment Company, of Memphis, Tenn. This mine carries high-grade silver ores, and will be added to the list of shippers within the next 60 days.

Rochester Group—This group of claims, situated on Bald mountain, has been bonded by the owners, Brown & White, to an Eastern syndicate, who will commence active work within the next 30 days.

Leona Group—This group, consisting of the Leona, the Edna and the Lone Bug claims on Nigger hill, have been leased by T. A. Brown, of Breckenridge, to Condon & Shrock, who are well known as successful operators of several good leases in this camp.

Colorado Consolidated Mining and Electric Company—This company, with William H. Baker as manager, has assumed entire possession of the Gold Pan Mining and Electric Company's plant and other assets. Mr. Baker intends to unwater the big pit and do a large amount of prospecting this stason.

Old Union Mining and Milling Company—This company has made another important strike in the main tunnel; a body of 2 ft. of solid zinc ore was met with, assaying 38 per cent. zinc.

Sallie Barber Mine—This mine was visited by some of the directors recently. Mr. Gray, as manager, was replaced by John Harrison, of Salida. The company has a large quantity of shipping-ore on the dump awaiting the transportation when the roads get into better condition.

FLORIDA.

POLK COUNTY.

Phosphate Mining Company—This New York corporation will commence the construction of a mining plant in the vicinity of the property of the Prairie Pebble Phosphate Company, near Mulberry, within the next few weeks. It is expected that the new plant will be in operation within a year. The output, it is estimated, will be about 150,000 tons annually. C. G. Memminger, Lakeland, Fla., is the constructing and mining engineer, and later, when the plant is in operation, will assume the duties of general manager.

INDIAN TERRITORY.

It is stated that the Missouri, Kansas & Texas Railway Company has decided to withdraw from the mining of coal for commercial purposes and will confine itself strictly to the production of fuel for its own needs. The railway company has been largely interested heretofore in the operations of the Southwestern Coal and Improvement Company and has also had a very close connection with at least one other large producer in the McAlester district.

Carl Scholz, of Chicago, mining engineer for the Rock Island-Frisco system, Capt. John H. Mitchell, of Hartshorne, I. T., prospector for the Rock Island, and R. V. LeGrande, a promoter, of Dallas, Tex., are looking over the oilfields in the vicinity of Ardmore, I. T., with a view of finding fuel oil for use of engines of the Rock Island-Frisco System. The indications are that an abundance of good fuel oil can be found in the Indian Territory.

MICHIGAN.

HOUGHTON COUNTY—COPPER.

Baltic—The new air compressor for No. 2 shaft has been shipped from the shops of the Nordberg Manufacturing Company, of Milwaukee, Wis., and will be installed at this mine as soon as possible. The new steel shaft and rock house at No. 2 is completed. It is expected the shaft will begin shipping rock before June and it should provide enough tonnage to enable the mine to increase its output 20 per cent.

Franklin—Estimates of the production of this mine must necessarily be revised. The yield of refined copper in the mineral produced last year was unexpectedly low, being slightly less than 51 per cent., as compared with 60 per cent. the year before. This is lower than the average grade of mineral produced in the district, the Wolverine, Osceola, Mohawk and other mineral running 70 to 85 per cent. refined copper.

Osceola Consolidated—Estimates are made regarding the production of this mine from month to month, but they are in the majority of cases unreliable. Under normal conditions the mine can produce 21,000,000 lb. copper per annum, that being the capacity of the present mine and stamp-mill equipment. This estimate allows for the short interruptions caused by changes in the system of conducting work.

Wolverine—Structural steel for the new shaft and rock house at No. 3 shaft has been shipped. The structure will be rushed and it is expected to have the shaft, which was put out of commission by the fire, in shape for work in three weeks. The Wisconsin Bridge and Iron Company, of Milwaukee, Wis., has the contract. No. 4 shaft is the only one in commission, but it is shipping 1125 tons of rock daily.

KEWEENAW COUNTY—COPPER.

Mohawk—As soon as the plat at the fourth level in No. 5 shaft is completed, sinking will be resumed. At the third level the drift north connects with No. 4 shaft, but it is not in good ground. The third level drift south is 400 ft. long and in good copper rock. All levels, from the first to the seventh, inclusive, are connected from No. 1 to No. 4 shafts. The drifts on the fifth and seventh levels are each 5300 ft. long.

MISSOURI.

MILLER COUNTY.

Missouri Cannel Coal Company—This company has been organized, with $400,000 capital stock, to operate on a tract of 3300 acres of coal land near Versailles, where the office of the company is to be.

OREGON.

JACKSON COUNTY.

Cyanide Gold Mining Company—It is reported that veins carrying cinnabar in paying quantities have been found on this company's property three miles northwest of Ashland. Examinations of the property made by experts are encouraging.

SOUTH DAKOTA.

CUSTER COUNTY.

Ivanhoe—Dr. Ratte, the manager, has taken about 700 lb. of ore to Denver for a cyanide test. Should this prove satisfactory a cyanide annex will be added to the stamp mill.

New York Mica Mine—This property, located about six miles west of Custer, has just been sold to the Westinghouse Electric and Manufacturing Company, of Pittsburg. This mine has been considered to have the greatest amount and the best grade of mica of any property in this vicinity.

LAWRENCE COUNTY.

Gilt Edge Maid—Preparations have been made to change the plant from the wet to the dry-crushing process. Three new tanks will be installed for the purpose of increasing the capacity. It will take about six weeks to complete the work.

Montezuma—A syndicate of New York and Denver people has obtained control of this property and proposes to sink a 500-ft. shaft on the Brownie claim. The property is located in Deadwood gulch.

Reliance—Plans for the 150-ton cyanide mill have been completed and are in the hands of the company. Bids have been asked for and actual work will begin within 30 days. It is the intention to have the mill in running order by August 1.

Golden Reward—The Ruby Bell tunnel, driven to intersect the Union shaft, will be completed by May 15. It will be 1500 ft. long and will enable the company to work the Billy, Ruby Bell and lower Isadora orebodies at much less expense.

Ohio-Beaver Creek—The shaft on this property, located between the north and south forks of Beaver creek, has reached a depth of 130 ft. with strong mineral indications. Work will be prosecuted steadily through the summer. The stock is largely held by Columbus, Ohio, people.

Puritan—Work on this property, which was suspended for a short time, has been resumed. At present 150 tons of ore are treated daily and the mill has a sufficient capacity to handle 250 tons. More power is needed at the hoist, but it has not yet been decided whether to install steam or electric power.

New England Homestake—The machinery for this company has arrived and is being installed. It includes a hoist and air compressor. Ore can be handled with this outfit to a depth of 1000 ft. The shaft is down 60 ft. and the orebodies are showing good free-milling values.

Hidden Treasure—Work has begun on the construction of a hoist on this property. A 75-h.p. electric motor will be installed and power will be furnished by the Consolidated Power and Light Company.

PENNINGTON COUNTY.

Gertie—The first smelting test has been made at this mine and the first block of pig tin produced. A small smelter has been erected on the ground of the company and the refined metal will be produced from now on. M. L. Moyer, of Cleveland, is supervising the work.

UTAH.

BEAVER COUNTY.

Pine Grove Mining Company—This corporation has 18 patented claims in the Pine Grove district and as many more unpatented. The directors are about to consider the advisability of providing mill facilities. L. S. Hills, president of the

Deseret National Bank, Salt Lake, is one of the principal owners.

Lulu—Developments at this property continue to be of an encouraging nature. The mine will soon be a shipper.

Skylark Copper—The shaft is being lowered in this property.

BOX ELDER COUNTY.

Utah Smelting Company—The railroad spur to the site of this company's plant will soon be completed and structural material will begin to arrive early in May.

JUAB COUNTY.

Tintic Shipments—Last week these were lighter than usual, owing to bad roads, being 152 carloads, the shippers and amounts being: Ajax, 2; Black Jack, 1; Beck Tunnel, 3; Bullion Beck, 11; Centennial Eureka, 50; Carisa, 1; Dragon Iron, 2; Eagle & Blue Bell, 6; Eureka Hill, 6; Gemini, 22; Grand Central, 8; Joe Bowers, 1; Lower Mammoth, 5; Mammoth, 15; May Day, 4; Ridge & Valley, 4; Swansea, 2; United Bingham, 1; Uncle Sam, 2; Victoria, 6 cars.

Eagle-Blue Bell—An extensive body of gold ore has been encountered on the 1000 level. Its extent has not been determined.

MORGAN COUNTY.

Carbonate Hill—On account of snow and mud, ore shipments from this property have been temporarily suspended. They will be resumed about May 1. Mine development continues as usual. M. A. Daugherty, of Salt Lake, is manager.

SALT LAKE COUNTY.

Winnemuck—The development of this old-time Bingham producer has been undertaken again. It is now an asset of the Ohio Copper Company.

New England Gold and Copper—This company is building a boarding house to accommodate a large force of employees. An air compressor plant has been ordered and will be installed immediately. The mill is running steadily.

SUMMIT COUNTY.

Park City Shipments—These aggregated 4,094,860 lb., the shippers and amounts being: Daly West, 1,400,000; Silver King, 1,617,680; Little Bell, 110,000; Daly Judge, 773,000; Daly Judge (zinc middlings), 194,000.

Thompson—It is reported that work is to be resumed at this property soon.

Daly Judge—On the 1500-ft. level of this mine, an ore shoot is being drifted on two ways, and has been opened to the extent of 250 ft., still with no indications of the end of it. Neither has the width been ascertained. The ore carries a large percentage of lead and iron, making a desirable smelting product.

New York Bonanza—This company has been extracting ore from an 18-inch streak, carrying high values on the 700-ft. level.

Little Bell—The initial shipment, 205,540 lb., was sold on control assays, showing 69 oz. silver, 22 per cent. lead, 2.3 per cent. copper and 0.05 oz. gold. Fifty tons more will be marketed this week.

VIRGINIA.

FAUQUIER COUNTY.

Appalachian Conduit Company—This company is now down 120 ft., with its drill at Casanova, and expects to strike the first coal measures soon. The company is now buying a new drill, having a capacity of 2500 ft. depth. Mr. Cadmus, the manager, has gone to Cuba; on his return the new drill will be put at work on the company's property at Broad Run.

WASHINGTON.

FERRY COUNTY.

Quilp—The mine is closed down, to await a new contract for ore deliveries, the old contract having expired.

Copper Key—The upraise is heading 40 ft. above the No. 2 tunnel level and continues in a good quality of shipping ore. Superintendent Angus believes this will be found connected with the larger body, developed on the upper level.

Mountain Lion—Expressions of distrust of the stated results of the tests at the mill have led to a challenge by responsible parties, who will offer the Mountain Lion Gold Mining Company to put up the money for the purchase of concentrating tables and all other machinery needed for milling the ore, provided the company will give them a lease of the mine.

Pearl Consolidated—Three carloads of good ore were shipped the past week to the B. C. Copper Company's smelter, at Greenwood, B. C., and it is hoped to increase the shipments to a full carload a day. A drift has been started southwest on ore, on the bottom level of the Lone Pine Workings. The working force has been decreased to 12 men. Ore is being stoped between the middle and bottom level.

Mountain Lion Gold Mining Company—In the case of Albert Mac Laren vs. this company. Judge Whitson of the United States Circuit Court has handed down a decision in favor of the plaintiff, sustaining complaint in action to foreclose his mortgage on the realty of the defendant in Republic camp. This includes the Mountain Lion mine and improvements thereon. The case was closely fought, and the judgment rendered included $5000 for attorney's fees. The opinion was filed in the circuit court April 7 sustaining the validity of the mortgage. August 18, 1903, this company executed a note for $60,000, payable to Albert MacLaren on demand, with interest at the rate of 8 per cent. per annum. The company subsequently passed a resolution authorizing the cancellation of that and the issuing of a new note secured by a mortgage on the company's property; in place of which a mortgage was given to secure the payment of the original note. The defendant alleged that there was no authority for the issuance of the mortgage, because it was not in pursuance of the resolution as passed by the board of directors; that there was no consideration for the company and that the company was insolvent at the time the mortgage was given. The defendant further alleged that the complainant was not the holder of the note at the time the mortgage was given; that he had previously indorsed it to the Bank of Montreal, and the officers of that bank had held the complainent or looked to him for the payment, according to the officers' testimony; that the complainant subsequently took up the note and brought the suit of foreclosure.

The court held that while there was no express authority by the board of directors for executing the mortgage, yet there was authority for securing the debt and that it subsequently came to the knowledge of the directors and the stockholders that the mortgage was given, and with such knowledge they had permitted the complainant to rely thereon for a period of about 18 months in place of repudiating the action of the directors. The court also found in favor of the complainant that at the time the note was executed and the money advanced by him it was agreed that the mortgage should be given and that this constituted sufficient consideration. The court further held that there was not sufficient evidence of insolvency.

The court awarded a decree for the complainant for the principal, interest and costs, $5000 attorney's fees and the taxes paid on the property by the complainant.

Anonymous—A stringer of good ore has been cut in the tunnel.

Foreign Mining News.

CANADA.

In accordance with the action taken at the recent annual meeting of the Canadian Mining Institute in Quebec, a deputation from the Institute visited Ottawa April 18, and interviewed Premier Laurier and other members of the Canadian Government, asking for increased recognition of the mining industry. They urged that the whole mineral department should be placed under one head instead of being divided, part of the work being now under the Geological Survey, and part under the superintendent of mines, in the Ministry of the Interior. They proposed that the Mines Branch, the Topographical Survey, the Geological Survey, and the new National Museum should be all under one head and responsible directly to a Minister of Mines, which would prevent the duplication or overlapping of work, and promote efficiency.

BRITISH COLUMBIA.

Tyee Copper Company, Ltd.—This company reports that its smelter at Duncans Station, Vancouver Island, ran 13 days during the month of March, treating 2153 tons of Tyee ore, giving a return, after deducting freight and refining charges, of $37,965. This is an average of $17.63 per ton.

MEXICO.

SONORA.

Greene Consolidated Copper Company—Great improvements are being made in the concentrating department of this company. Seventy-two Frue vanners and 36 Wilfley tables are being added as fast as possible and when the addition is finally made the capacity of the concentrator will be increased 1000 tons daily. The present capacity is 2400 tons. Two new furnaces are to be added to the smelter, of the Anaconda type. New hoists have been ordered for four of the shafts.

San Bernardino Copper Company—A small shipment of average-grade ore was made from this mine last week for the purpose of ascertaining the values of the ores under mill treatment. The net profits were $53.50 per ton. Encouraged by this showing the owners and stockholders have decided to increase the force of men at the mine and to get a new hoist. The water, which has caused so much trouble in the past, has been overcome.

Ronquillo Copper Company—The unexpectedly high grade of the orebody in this mine has decided the stockholders to push development. The force of men at the mine has been doubled. This mine is located in the Manzanal range of mountains, about 18 miles south of Cananea.

Ajos Mountains District—The discovery of copper deposits in the Ajos mountains is creating quite a boom. This district is about 20 miles west of Fronteras and 35 east of Cananea and is reached by good roads from both places. The two companies most prominent in developing this district are La Union Consolidated Copper Company and the Brooks Consolidated Copper Company. Both these are American corporations. La Union is composed of Minnesota people and the Brooks of Cananea, Bisbee and Douglas people. On La Union property, in one shaft at less than 40 ft., 230 tons of ore were taken out which gave returns of 6 per cent. copper, $2 silver and $7 gold. In a prospecting shaft which has been sunk to 100 ft., a 2½-ft. body of ore has been encountered. The Brooks is in the middle of the boom district and the country for five miles around has been denounced and taken up. This company is located about 2½ miles northwest of La Union.

Arizpe-Moctezuma Development Company—This company is working two mines known as the Alacran and Rey de Cobre, is situated 17 miles southeast from Cananea. In a development shaft on the Rey de Cobre it was expected that copper ore would be located at about the 200-ft. level but at 105 ft. a large and well defined ledge of ore was cut.

Campana de Sonora—The last shipment from this mine in the Sierra Azul mountains, 25 miles south of Cananea, netted for the fourteen tons shipped a total of $1,700. During the winter months work was discontinued, but for the past month work has been progressing very favorably. The tunnel is in the hill 150 ft. and the shaft is down 40 ft. The property is owned by V. R. Parker and is within six miles of the wagon road, in a well-timbered and well-watered country.

Picacho Mine—The purchase of the Picacho mine of the Phelps-Dodge Company by the Clancy Brothers, owners of the Oro Maximo mine in the same district is the most noteworthy event in the mining industry of Sonora. This mine has been known for the past five years as a great mine. While under the former control, it was necessary to pack all the ore to Turicachi and then ship it to El Paso for smelting, but under the management of the Clancys the ore will be milled at their mill on the Oro Maximo property about 2½ miles distant. This mill has been ordered and will be in operation before August. It will have a daily capacity of 200 tons and will treat both the ores from the Oro Maximo and the Picacho, as these are similar. The mill was designed by W. L. Holmes, of Mexico City, and R. K. Clancy, manager of the properties. Work is being done on both properties, getting them ready for the mill. The mill-site is ready, the water-lines for the camp and the water tanks are ready, and the road connecting both properties is almost finished.

Sierra de Cobre—New pumps have been installed at the mine and the water is rapidly being overcome. Development work has been retarted on this property by the water. The Copper Queen Company, which owns the mine, is preparing it to become a large mine. The mine is close to the Elisa mine of the Greene Consolidated Copper Company.

AUSTRALIA.

At the ninth ordinary general meeting of the Anglo-Australian Exploration Company, held in London recently, it was announced that the directors had acquired options on the Great Morgan Consolidated and Gibraltar gold mines in New South Wales, and that the company's engineers were examining other properties in that State which had been offered for sale. The company's investments in Australia—which include large holdings in the Mount Boppy Gold Mine, in New South Wales, and the Tasmania Gold Mine, in Tasmania—have proved very successful.

WESTERN AUSTRALIA.

Gold production in March was 155,575 oz. fine, a decrease of 9877 oz. from March, 1905. For the three months ending March 31 the total output of gold was, 480,403 oz. in 1905, and 452,367 oz. in 1906; showing a decrease of 28,036 oz., or 5.8 per cent., this year.

NEW ZEALAND.

The Mines Department reports the gold and silver exports in January as follows, in ounces:

	1905.	1906.	Changes.
Gold	58,132	61,704	I. 3,572
Silver	43,863	85,552	I. 41,689

The gold is reported as bullion; the total this year was equal to 58,821 oz. fine gold, or $1,215,830 in value.

Coal Trade Review.

NEW YORK, April 25.

The coal situation in the West shows little change. The Indiana proposition to arbitrate differences has, apparently, fallen through, and no progress has been made toward a settlement. There is little doubt, however, that the continued activity in the Pittsburg district, the weakening of the operators and other causes will force a general settlement before long.

The Southwestern operators are holding out firmly, and most of the mines in that territory are idle..

The anthracite region is still unsettled; much depends on the meeting of the miners, which is now in session. It is altogether probable that, if nothing results from that meeting, the operators will make an effort to re-open the mines. The local feeling seems to be divided, from all accounts. There is, however, none of the bitter feeling which marked the outbreak of 1902; and there is a possibility that this week will see a settlement.

Under all the circumstances there is, up to the present time, no shortage of coal supply anywhere, notwithstanding the temporary closing of many mines.

COAL TRAFFIC NOTES.

The total coal and coke traffic originating on all lines of the Pennsylvania Railroad east of Pittsburg and Erie for the year to April 14, was as follows, in short tons:

	1905.	1906.	Changes.
Anthracite	1,209,320	1,347,040	I. 137,720
Bituminous	7,891,550	10,092,395	I. 2,200,845
Coke	3,142,468	3,649,253	I. 506,785
Total	12,243,338	15,088,688	I. 2,845,350

Shipments of Broad Top coal over the Huntington & Broad Top Railroad for the week ending April 21, were 1653 tons; for the year to April 21 they were 289,460 tons.

The Ohio Coal Traffic Association reports coal tonnage for the two months ending Feb. 28 as follows, in short tons:

Railroads.	1905.	1906.
Hocking Valley	557,784	702,303
Toledo & Ohio Central	252,635	334,004
Baltimore & Ohio	316,879	318,142
Wheeling & Lake Erie	439,654	575,622
Cleveland, Lorain & Wheeling	300,724	471,966
Zanesville & Western	179,209	226,052
Toledo Division, Penna. Co.	407,422	509,809
Lake Erie, Alliance & Wh'ling.	134,305	210,317
Total, net tons	2,588,612	3,348,215

This shows an increase of 759,603 tons, or 29.3 per cent., this year.

New York. April 25.

ANTHRACITE.

The anthracite coal market, so far as the present outlook is concerned, hangs on the miners' meeting which begins its session today. If the operators' terms are not accepted, the suspension will become a strike. Meantime a few collieries and washeries are at work, and preparations are being made to open others, in case there is no settlement. The trade waits events, and, up to the present time, no scarcity of coal is evident. The usual summer discount will not be made this year. Prices therefore remain at the old level; $4.75 for broken and $5 for domestic sizes. Steam sizes: $3 for pea; $2.25@2.50 for buckwheat; $1.45@1.50 for rice and $1.30@1.35 for barley f.o.b. New York harbor shipping points.

BITUMINOUS.

The Atlantic seaboard soft-coal trade seems to be in rather an extraordinary condition; with a great many mines in central Pennsylvania closed down on account of labor conditions, the market seems to be weak, with a plentiful supply of coal for the demands.

This can only be accounted for by the preparations made by the consumers generally in expectation of trouble on April 1, in both anthracite and bituminous fields. The absorption of coal coming forward at the present time seems to be in the way of replenishing stocks that have been depleted by daily consumption. Some people say that with the mines that are not producing there must be a shortage before long; but there is none showing at this time, nor are there indications of it. We hear of heavy tonnages in vessels awaiting discharge at one or two of the Eastern ports. As to the labor question in central Pennsylvania, both sides at this time seem to be pretty well determined; it has been stated by some producers that giving in to the demands made by the men is a question of the life of the mine.

Trade in the far East is not as active as is desired; such heavy shipments have been made by the Southern ports that there is difficulty in absorbing them. Trade along the Sound is not excessively active, and the consumers could have more coal shipped them if it was called for. Trade in New York harbor is more of a speculative character than in other localities, though prices have been drooping in the last week, ordinary grades of steam coal being offered at $3 f.o.b. New York harbor shipping ports, with no takers.

All-rail trade does not show the activity that one would expect with central Pennsylvania mines out. Consumers of all-rail coal seem to have prepared pretty well for strike contingencies, and those who had not put in enough have been able to fill up with West Virginia coals.

Transportation from mines to tide continues good. Car supply is up to all demands, even Baltimore & Ohio shippers receiving practically their daily requisitions. The coastwise vessel trade seems to be supplied with enough vessels to go around, and freight rates are about maintaining themselves. We quote rates of freight from Philadelphia as follows: To Boston, Salem and Portland, 75c.; Providence, New Bedford and the Sound, 60c.; Lynn, Newburyport, Gardner and Bangor, 85c.; Saco, 90c. and towage. The further lower ports are paying from 15 to 20c. above these rates, and in some cases higher.

Birmingham. April 23.

Alabama coal producers have been selling their product in great quantities and in some instances orders have been accepted that will require steady delivery for two and three months to come. The Mobile & Ohio railroad placed orders in this district for 500 carloads of coal. This was followed by other large consumers or dealers in coal and the statement is made on good authority that enough orders are in hand or in sight to keep the mines in this State in steady operation through the entire summer. The coke production shows no change. Steps are being taken to increase this output. New washers will be erected and several of the washers already in operation will be enlarged and otherwise improved. Coke still brings a good price.

Chicago. April 23.

The coal market continues to be dull, chiefly on account of the stores of large consumers. Prices generally are low, and the volume of sales is not large. Public opinion seems to be optimistic, the feeling being generally expressed that the strike will be over before there is a pinch for coal supplies. Consequently, consumers, large and small, are refusing to order for immediate delivery, except where it is absolutely necessary. The slackness applies to both eastern and western coals, including anthracite. And this, despite the fact that stores of western coals are nearly out, with the probability that there must be general buying in the market within the next two weeks.

Contract business has been generally cancelled by the strike, and there is of course little or no business being done in new contracts. Stores of bituminous coal are not yet exhausted as regards steam users, and eastern coals that are freely in the market are getting much of the new business. This may, of course, result in a large increase for the eastern agents, but the public that has bought Illinois and Indiana coal at a low price is not likely to take permanently to West Virginia and Pennsylvania coal at a high price.

The little supply of Illinois and Indiana coals available sells for about $2.75@3 for lump, $2.50@2.75 for run-of-mine and $2.25@2.75 for screenings. Smokeless is quoted at $3.25@3.40 for run-of-mine; Youghiogheny at $2.90@3.15 for three-quarter, and Hocking at $3.25@3.40. A little Kentucky coal is coming into the market and selling for about $3, with no great demand.

Cleveland. April 24.

The coal trade in this territory has shown some improvement during the past week. The production of steam-coal has been curtailed by the fact that most of the middle district mines are still shut. The possibility is that they will not resume operations until the middle or latter part of May. By that time the stocks on hand will have been about wiped out. In the meantime the market is dependent for its supply on the Pittsburg district and the stocks collected. The stocks are sufficient for the needs of the manufacturing concerns, while the output of the Pittsburg district is feeding the transportation companies and the lake boats, beside giving a supply for shipment to the head of the lakes. In the lake trade there is less call for boats; they are in fair demand, however, at 40c. to Lake Michigan and 30c. to the head of the lakes.

Steam coal in this territory is selling at $2@2.10 delivered, which is slightly higher than a week ago, and slack is worth $1.60@1.80 delivered. Coke is steady at $3.25 for the best grades of 72-hour foundry and $2.50@2.75 for furnace, at the oven.

Pittsburg. April 24.

Coal—Owing to the idleness of western mines the demand for coal in the Pittsburg district is unusually heavy. All the mines are in full operation, and additional miners are being put to work daily, as strikers from other fields continue to come in. The railroads are furnishing all the cars needed; production and shipments are greater than at any period in the history of the mining industry in this section. The Pittsburg Coal Company is crowding its shipments to Lake ports in order to get as large a tonnage as possible on the way to the northwestern markets before the threatened trouble with the pilots and other lake organizations occurs on May 1. The present wage agreements with these organizations expire on April 30, and it is likely there will be some difficulty in adjusting the new scales. The lake navigation season did not open until April 15, but despite the fact that cargoes could not be insured until that

date several vessels were started more than a week earlier, and all reported to have arrived safely. When the first consignment of coal reached the Northwest the docks were bare; a year ago there was fully 500,000 tons in stock when the first shipment of the season arrived. Indications point to a greater tonnage being shipped from the Pittsburg district to the Northwest this season than in any former year, unless labor troubles interfere. Prices are higher this week, and the minimum quotation for mine-run coal is $1.15 a ton at the mine. Representatives of the United Mine Workers and the coal operators have been in session here for several days to arrange the district deadwork scale. The operators strongly oppose some of the demands made, but it is believed a satisfactory adjustment will be reached in a few days.

Connellsville Coke—The demand continues heavy for furnace coke and prices are firmer. Furnace coke is quoted this week at $2.50 and foundry at $3 a ton. The production for the week exceeded 270,000 tons, and the shipments from the Connellsville and Masontown fields amounted to over 360,000 tons.

Foreign Coal Trade.

April 25.

Exports of fuel from Great Britain, with coal sent abroad for the use of steamships engaged in foreign trade, were as follows for the three months ending March 31, in long tons:

	1905.	1906.	Changes.
Coal	11,041,531	12,552,914	I. 1,511 380
Coke	148 684	174,456	I. 25,792
Briquets	270,188	357,426	I. 87,238
Total exports	11,460,386	13,084,796	I. 1,624,410
Steamer coal	4,145,653	4,544,719	I. 399,066
Total	15,606,039	17,629,515	I. 2,023 476

The coal shipped to the United States, included above, was as follows:

	1905.	1906.	Changes.
Atlantic ports	12,986	19,116	I. 6,130
Pacific ports	12,593	.....	D. 12,593
Total	25,579	19,116	D. 6,463

No shipments to the Pacific coast are reported this year.

Some of the larger exports this year were to: Italy, 2,171,537; France, 2,115,428; Germany, 1,536,466; Spain 726,207 tons.

Iron Trade Review.

NEW YORK, April 25.

Reports from all quarters show greater activity in the trade, and a disposition to extend purchases further ahead. New business is coming forward more freely, and orders are being placed for third and fourth quarter deliveries. In the Central West there seems to be a possibility of a shortage in bessemer and basic pig.

Lake navigation is open, and iron ore will soon be coming down. It is needed, for there has never been a time when the lower Lake docks were so bare of ore. It is possible, however, that navigation will be impeded by labor troubles in May.

United States Steel Corporation—The statement for the first quarter of the year shows net earnings, after deducting all working expenses, maintenance and renewals, as follows:

	1905.	1906.
January	$6,810,847	$11,856,275
February	6,629,463	10,958,275
March	9,585,586	13,819,840
First quarter	$23,025,896	$36,634,490

The March earnings this year were the highest ever reported in a single month. The income statement is as follows:

Net earnings as above	$36,634,490
Depreciation and reserve	$4,069,879
Sinking fund, sub. companies	255,729
Interest and sinking fund	6,936,963
Total charges	$11,262,571
Balance	$25,371,919

Appropriations from this balance were $6,304,919 for dividend on preferred stock; $3,000,000 for special improvement fund; $10,500,000 for new property and construction; a total of $19,804,919, leaving a surplus of $5,567,000. The unfilled orders on March 31 amounted to 7,018,712 tons of material; a decrease of 586,374 tons during the quarter.

Birmingham. April 23.

Alabama pig-iron manufacturers appear to be satisfied. Production is still off somewhat, the home consumption is improving and shipments are about the same as they have been since March 1. There is a good line of inquiry and recently some healthy orders were booked, delivery to be made during the third quarter of the year. The pipe-makers appear to have been in the market to cover the balance of their year's needs. The iron prices in this district are firm, the larger companies still holding at $14 per ton No. 2 foundry and the smaller producers not being able to sell under that price. There is not much iron on the yards in this district. The Sloss-Sheffield Steel and Iron Company will blow in the city furnace, which has been undergoing repairs, shortly.

The following quotations are given: No. 1 foundry, $14.50; No. 2, $14; No. 3, $13.50; No. 4, $13; gray forge, $12@12.50: No. 1 soft, $14.50; No. 2 soft, $14.

There is no change in the steel conditions in this district. The steel nail mills of the Southern Steel Company, at Ensley, which were destroyed by fire in January, will be ready for a resumption of operation next week.

Announcement is made that the American Radiator Company will erect a plant in this district. The Brooklyn Foundry Company will erect a small soil-pipe foundry at North Birmingham, expending something like $25,000, and giving employment to 25 or 30 men. Rumors prevailed that the Southern Railway had under consideration the erection of locomotive works in the South and Birmingham began efforts to locate them. An official denial was given to the rumor.

Chicago. April 23.

Radical improvement of the market for pig iron, from the seller's point of view, has occurred in the last week. The buying has been heavy, and it has not changed greatly in character, being chiefly for delivery as soon as possible. This buying of spot iron heavily is taken by the iron trade to mean that melters have been running for several months with as little iron as possible, and the continual expansion of their business is now forcing large purchases.

Prices have not changed to any extent with the sudden increase of buying. Northern No. 2 runs $19@19.50, and Southern No. 2, $14@14.50 Birmingham, or $17.90@18.40 Chicago. The demand is well divided between the two, though Southern iron has an advantage in the price.

Contracts for the third and fourth quarter supplies are steadily increasing in number, though much iron remains to be bought for the third quarter. Inquiries are good. It is probable that 60,000 to 70,000 tons were bought last week in Chicago territory.

Finished materials are steady in demand, though structural material is somewhat dull. General indications for the iron and steel trade continue promising.

Cleveland. April 24.

Iron Ore—The ground is still frozen at the head of the lakes and the ore is frozen in the pockets at the docks. This is making the shipment light and loading difficult, until warmer weather comes. Shippers have difficulty in keeping contract boats busy. The conferees at Erie last week were unable to agree and the result was that the longshoremen cannot change their attitude toward the dock managers for another three weeks. This promises a tie up of Lake Erie docks for the first two weeks of May at least. Marine interests show a disposition to operate the docks with non-union labor.

Pig Iron—The buying of pig iron of the foundry grade, has been heavy during the week. It seems also to be general over the territory. While all of the larger consumers are not coming in the buying is representative. This is important in view of the fact that the demand is for material for the third quarter and all through the second half. The market has stiffened under the heavy tonnage placed and now $16.50 in the Valleys is the minimum, with as high as $17 in the Valleys paid for No. 2. Bessemer is strong at $17.25 in the Valleys.

Finished Material—The larger sizes of structural are strong, with premiums being paid. Angles 3 in. and under are easy, with prompt shipments offered by all mills. Sheets have been strong, the

small mills being hampered by a shortage of sheet-bars. Plates are easy, with the buying light and specifications not coming in to suit the mills. Bars are easy, with prompt shipments posible from all mills. The price holds steady at 1.50c. Pittsburg for both bessemer and open-hearth. Bar iron is easy at 1.55@1.60c., Youngstown.

New York. April 25.

Pig Iron—Business has been active, and a good deal of buying is reported. Small orders come in freely, and some larger transactions are reported closed or under negotiation. Northern iron holds steady; for Southern there has been some readjustment of prices, which is not a reduction.

For Northern iron in large lots we quote: No. 1 X foundry, $18.50@19.25; No. 2 X, $18@18.75; No. 2 plain, $17.50@18; forge, $16.25@16.75. Southern iron is held firmly by the larger companies on the basis of $14 Birmingham for No. 2. For large lots on dock, New York, prices are: No. 1 foundry, $18@18.50; No. 2, $17.50@18; No. 3, $17@17.50; No. 4, $16.25@17; No. 1 soft, $18.25@18.50; No. 2 soft, $17.50@18; gray forge, $16.25@16.50. Basic is held at $19 for Virginia, $18:50 for Alabama and $18 for Northern.

Cast-Iron Pipe—Prices are steady, the present basis being $30.50 per net ton for 6-in. pipe in carload lots at tidewater points. Some large city contracts for New York and Philadelphia are pending.

Bars—Business is good, but prices are unchanged. Sales are at 1.645@1.695c. for common iron bars, and 1.745c. for refined iron. Steel bars are also 1.645c., tidewater. Store trade is fairly active at 2c., delivered.

Plates—Steel plates are in steady demand. Tank plates are nominally 1.745@1.825c.; flange and boiler, 1.845@1.945c.; universal and sheared plates, 1.745@1.845c.; according to width. Sales here have been chiefly in small lots.

Structural Material—Prices are nominally unchanged. Beams under 15 in. are 1.845c. for large lots; over 15 in., 1.895c.; angle and channels, 1.845c., tidewater delivery. Jobbers ask a considerable advance on small orders. New business is hesitating a little.

Seel Rails—No change in standard sections. Light rails are in steady demand. prices ranging from $26 for 25-lb. up to $33 for 12-lb. rails. The demand for trolley rails is good. The Tennessee Coal, Iron and Railroad Company is asking $29 for its basic open-hearth rails.

Old Material—Business is better and dealers hold for better prices. No. 1 railroad wrought is $18.50@19.50; No. 1 yard wrought can be had for $17@18; machinery cast, $14@14.50; heavy steel melting scrap, $16@16.50. These prices are on cars, Jersey City or other terminal delivery.

Philadelphia. April 25.

Pig Iron—There has been some buying of pig iron this week for delivery during the third quarter. The demand extends over all kinds of pig, but the larger purchases have been of basic iron and of pipe iron. There is quite a demand in small lots for special kinds of iron for engineering plants and this line of inquiry is on the increase. Whatever weakness may have been rumored a few days ago has certainly disappeared. The change in the situation is in the inquiry for third-quarter delivery. Several lots of Virginia and Alabama irons have been taken, as well as iron from eastern Pennsylvania. Less is being done in forge iron than any other kind, but the mills are making full time. The pipe-iron mills are overcrowded with work. The transactions foot up some 15,000 to 18,000 tons, and it is stated that there are inquiries for at least 25,000 tons of pig iron for pipe. The quotations for No. 1 X foundry are $19@19.50; No. 2 X foundry, $19; No. 2 plain $18.50 and standard gray forge $16.50@17. Basic is quoted at $17.50; malleable at $19, and bessemer at $20.

Steel Billets—The pressure on the mills for billets is just at present greater than it has been at any time since the opening of the year. The difficulty is that the new customers want steel within 30 days. As high as $30 has been paid for open-hearth steel, and forging steel ranges from $32 to $35.

Bars—There is no probability that prices will be changed until fall. There has been a good deal of inquiry for common iron. The lowest price for first-class bars is 1.63½c. The retail trade among the small mills is very active.

Sheets—Card rates remain. There is a good wholesale and retail business.

Pipes and Tubes—A good demand prevails for both pipes and tubes. A great deal of new business is constantly bobbing up.

Merchant Steel—Every consumer of merchant steel in this territory is running full time. The mills will not look at new orders, excepting at full prices.

Plates—Some business has been done in plates at slightly shaded figures. The larger concerns are bidding on some new business that is in sight, but the buyers are hesitating over the matter of concession which the mill-owners are not disposed to grant to any extent. Quotations for tanks and bridge plate in small lots are 1.78½; flange, 1.88½; locomotive steel, 2.28½ cents.

Structural Material—The tumbling in of orders for structural and fabricated steel still continues and the mills are finding it difficult to accommodate themselves to the deliveries upon which buyers insist. Our people report already some inquiry from the Pacific coast, but the inquiries have not yet taken any very definite shape.

Steel Rails—Some contracts have been placed already this week and if the mill people could come to an understanding there would be 100,000 tons contracted for during this week and next.

Scrap—The scrap people have everything their own way in all the more salable lines of scrap, such as railroad, No. 1 steel, No. 1 yard scrap and machinery scrap. Other kinds are selling well and are bringing the usual prices. Railroad scrap is held very high and some sold at $20.50 per ton.

Pittsburg. April 24.

The pig-iron market continues active but there were no large sales during the week. One independent furnace interest was forced to reject an order for 3000 tons of bessemer iron at $17.50, Valley, for May and June shipment, as it has no iron to spare. A number of orders for 200 and 300 ton lots also have been refused and there promises to be a shortage of bessemer iron for delivery in the second quarter. The United States Steel Corporation has optioned all the available bessemer iron of the Bessemer Pig Iron Association for May and June and was figuring on getting about 30,000 tons. According to estimates made today the association will not have the tonnage expected. Buyers of small lots are in the market but will have considerable difficulty in placing their orders. It is reported there is some speculative iron that may be had for delivery during the next two months and the price in small lots likely will be about $17.75. Several inquiries for large tonnages for third quarter delivery have been received and $17.50, Valley furnaces, was quoted, but so far no sales have been closed. A leading producer today declared confidently that this would be the minimum price for third quarter. There is no apparent scarcity of foundry and gray forge, but prices are not as strong as for bessemer. One of the chief causes of the scarcity of bessemer iron is the shortage of bessemer ore, but this will be relieved in a few weeks. The Lake navigation season opened over a week ago and high-grade ores are being shipped. The facilities for carrying ore will be much improved this season. Two new vessels which were built by the Great Lakes Engineering Company at Detroit went into service on Sunday, and another built by the same company for the Shenango Furnace Company will start tomorrow. These each have a carrying capacity of 10,000 tons.

The agricultural implement makers have placed their contracts for steel bars for the season which opens in July, the total tonnage ranging from 175,000 to 200,000 tons. It is understood a concession of about $2 a ton was made on this business, the price said to have been agreed upon being 1.40c. This is a trifle higher than last season's bars. The market is firm at 1.50c. Orders for structural ma-

terial continue to be placed and all the mills are being operated to capacity. The San Francisco disaster is expected to create a considerable demand for steel to rebuild the city and the structural mills will have enough business to keep them in continuous operation the rest of the year. Orders for steel rails are still being booked and it is believed the mills will have some difficulty in filling all contracts for this year's deivery. The Tennessee Coal, Iron and Railroad Company has opened its books for 1907 and is reported to have received contracts for from 75,000 to 100,000 tons of open-hearth steel rails at the price it established several weeks ago of $29 a ton. The northern mills will open their books for 1907 rails in a short time and there is not likely to be any change in the price for bessemer steel rails, which will be $28 for another year. There is an excellent demand for all lines of finished steel products. In plates the large mills cannot guarantee delivery inside of 60 days. Common iron bars are weaker and 1.50c., Pittsburg, can be done. This is a drop of $1 a ton during the week. The scarcity of steel is more pronounced and some of the tin-plate and sheet mills are being forced to suspend operations. The new price of $3.60 a box for tin-plate is being maintained by the leading interest, but it is reported that some of the independents are shading this rate.

Pig Iron—Quotations today follow: Bessemer, $17.50@17.75; basic, $17; foundry No. 2, $16.50@17, all at Valley furnaces; gray forge, $16.50@16.75, Pittsburg.

Steel—Bessemer steel billets are quoted at $27.50; open-hearth billets and sheet-bars at $28. Plates are firm at 1.60c. and merchant steel bars, at 1.50c.

Sheets—The sheet market is very firm. Orders continue to be placed at the established rate of 2.40c. for black sheets and 3.45c. for galvanized sheets No. 28 gage.

Ferro-Manganese—For prompt delivery 80 per cent. ferro is quoted at $120 and for May and June shipment $110 is asked. No orders have been placed for second half and it is believed the price will be about $90 a ton.

Dusseldorf, Germany. April 12.

The German Iron and Steel Union has made public the following statement of the production of steel in Germany for the year 1905; the figures are in metric tons:

	Acid.		Basic.	
	Tons.	Per Ct.	Tons.	Per Ct.
Converter ingots	424,196	4.2	6,203,706	61.6
Open-hearth ingots	165,930	1.7	3,086,590	30 7
Direct castings.	65,369	0.6	120,762	1.2
Total	655,495	6.5	9,411,058	93.5

The total make of steel of all kinds was 10,066,553 metric tons. The ratio of steel to pig-iron production was 91.6, the highest ever reported.

The production compares with that of the previous year as follows:

	1904.	1905.	Changes.
Acid steel	610,697	655,495	I. 44,798
Basic steel	8,319,594	9,411,058	I. 1,091,464
Total	8,930,291	10,066,553	I. 1,136,262

The gain in acid steel was 7.3 per cent.; in basic, 13.1; in the total make, 12.7 per cent. Of the total, including both acid basic, 65.8 per cent. was made in the converter in 1905, against 66.6 per cent. in the previous year.

The German Iron and Steel Union estimates the consumption of pig iron in Germany in 1905 as below; the steel and finished products being reduced to their estimated equivalents in pig iron. The figures are in metric tons:

Pig iron production	10,987,623
Imports, pig iron	198,953
Imports, finished material, reduced to pig	164,795
Total supplies	11,351,371
Exports, pig iron	498,703
Exports, finished material, reduced to pig	3,799,201
Total exports	4,297,904
Balance, consumption	7,053,467

The production of pig iron was 181.3 kg. per head of population; the consumption was 116.4 kg. per head. These averages exceed those for 1904 by 12.1 kg. and 4.2 k.g., respectively.

London. April 17.

Exports of iron and steel, and manufactures, from Great Britain for the three months ending March 31 are valued by the Board of Trade returns as below:

	1905.	1906.	Changes
Iron and Steel	£7,181,297	£9,076,854	I. £1,895,557
Machinery	5,230,150	6,193,379	I. 963,229
New Ships	731,900	1,422,672	I. 690,772
Total	£13,143,347	£16,692,905	I. £3,549,558

Exports of mining machinery, included above, were £190,061 in 1905, and £181,419 in 1906; a decrease of £8642. The chief items of the iron and steel exports were, in long tons:

	1905.	1906.	Changes.
Pig iron	180 487	285,942	I. 105,455
Wrought iron	41,247	44,338	I. 3,091
Rails	133,586	100,919	D. 32,667
Plates	39,373	56,291	I. 16,918
Sheets	101,801	116,234	I. 14,433
Steel shapes, etc	46,033	60,962	I. 14,929
Tin-plates	95,659	91,771	I. 3,888

The total quantities of iron and steel of all kinds were 807,775 tons in 1905, and 992,411 tons in 1906; an increase of 184,636 tons, or 22.8 per cent. Exports of pig iron to the United States were 31,094 tons in 1905, and 55,084 tons in 1906, an increase of 23,990 tons; of tin-plates, 19,118 tons in 1905, and 10,873 tons in 1906; a decrease of 8243 tons.

Imports into Great Britain for the three months were valued as follows:

	1905.	1906.	Changes.
Iron and steel	£1,972 138	£2,485,288	I. £513,150
Machinery	1,156,430	1,242,334	I. 85,904
Total	£3,128,568	£3,727,622	I. £599,054

The total quantities of iron and steel imported were 317,539 tons in 1905, and 385,930 tons in 1906; an increase of 68,391 tons, or 21.5 per cent. The leading items of the imports were, in long tons:

	1905.	1906.	Changes.
Pig iron	32,412	21,071	D. 11,341
Wrought iron	20,719	36,811	I. 16,092
Steel billets, etc	148,214	164,268	I. 16,054
Bars and shapes	10,997	17,872	I. 6,875
Structural steel	27,730	42,701	I. 14,971

Imports of manganiferous ores for the three months were 83,425 tons in 1905, and 98,891 tons in 1906; an increase of 15,466 tons. Imports of iron ores were 1,596,659 tons in 1905, and 1,960,488 tons in 1906; an increase of 363,829 tons, or 22.8 per cent. Of the imports this year, 1,549,980 tons were from Spain.

Cartagena, Spain. April 7.

Iron and Manganiferous Ores—Messrs. Barrington & Holt report that shipments for the week were one cargo, 3800 tons Calasparra magnetic, to Rotterdam; two cargoes, 6650 tons dry ore; two cargoes, 6900 tons manganiferous ore, and one cargo, 2550 tons Calasparra magnetic, all to Great Britain. The local iron-ore trade continues to show great activity, and notwithstanding the fall in exchange, prices at mines continue to increase. Rates of freight remain remarkably low, some of the recent fixtures having been: Cartagena-Ayr 5s. 7½d. f.d.; Cartagena or Porman-Philadelphia. 7s. 9d. f.t.; Cartagena-Rotterdam 5s. f.d.

Quotations are 8s. 5d. for ordinary 50 per cent. ore; 9s@9s. 4d. for special low phosphorus; 11s. 9d. for specular ore, 58 per cent. iron; 10s. 2d. for S. P. Campanil. Manganiferous ores range from 11s. 8d. for 35 per cent. iron and 12 manganese, up to 18s. 2d. for 20 per cent. iron and 20 manganese. All prices are f.o b. shipping port.

Pyrites—Iron pyrites, 40 per cent. iron and 43 sulphur, are quoted at 10s. 6d. per ton, f.o.b. shipping port.

Heavy Chemicals and Minerals.

NEW YORK, April 25.

The quotations for heavy chemicals are shown in the table given herewith; and in particular:

Blue Stone (copper sulphate)—This has shown variable activity lately, not entirely dependent upon the price of the metal, but also in connection with the demand for insecticides.

Nitrate of Soda—We announced in a recent issue the re-adjustment of the combination on the West Coast. Prices have advanced, and have also shown irregularity, apparently in wavering sympathy with stocks at hand or afloat.

Phosphate—The market is stiffening on account of an apparent shortage for 1906; in accord with which quotations are advancing.

Potash Salts—New quotations were recently announced by the American agents of the German Kali Syndicate.

Pyrites—These have advanced decidedly, even 1908 futures having been quoted at enhanced figures.

PRICES.

"Alkali," per lb., future	0.75@.87½c
" " " prompt	.85@.95c.
Soda ash, 48%, per lb	1.?@1.3c.
Bicarb. soda, per lb	1.3@1.5c.
Bleaching powder, per lb	1.3c.
Soda, caustic, per lb., future	1¾@1.8c.
" " " April, May	2¼@3c.
Salt cake, per lb	.65c
Sal soda, per lb	.6@1.4c.
Soda, monohydrate, per lb	1¼@1¾c.
Potash, caustic, per lb	4⅛@6¼c.
" carbonate, 82-85%	3¾@4¼
Alum, per lb	1.75@1.85c.
Ammonia, aqua, 26 deg., per lb	4¾@5¾c.
Nitrate of soda, 100 lb. 96% for 1906	$2.30
95% for 1906	$2.25@2.27½
96% for 1907	2.20@2.22½
95% for 1907	2.17½@2.20
Saltpeter (pot. nitrate) per lb	4¼@5½c.
Potash, muriate, per cwt	$1.90@$1.98
Potash, kainite, per long ton	$8.50@9.50
Potash, sulphate, 90%, 100 lb	$2.18@2.21½
Sulphate of ammonia, per 100 lb	$3.05@3.07½
Hydrochloric acid, nominal, per lb	1.1c.
Nitric acid, per lb.	3¾@5¾c.
Sulphuric acid, 50°, bulk, per ton	$12 up.
60°, 100 lb. in carboys	1.00
60°, bulk, ton	18.00@20.00
66°, 100 lb. in carboys	1.00@1.25
66°, bulk, ton	21.00@23.02
Alcohol (ethyl) per gal	$2.45@$2.47
" (methyl or wood) 95%	$0.70
Arsenic, white, per lb., nominal	5½@6¼c.
" red, per lb	6¼@6¾c.
Blue stone (copper sulphate), carload, per lb	6@6.10c.
Sulphur.	
Louisiana (prime) to New York, Boston or Portland, ton	$22.12½
To Philadelphia or Baltimore "	22.62½
Tin.	
Crystals, per lb., varies with metal	24@27c.
Pyrite.	
Domestic, non-arsenical, furnace size, per unit	11@11½c.
Domestic, non-arsenical, finer, per unit	9@10c.
Domestic, arsenical, finer (Virginia)	8c.
Imported lump, non-arsenical, per unit	11½@12c.
Imported furnace size, non-arsenical, per unit	12@12½c.
Imported lump, arsenical, per unit	11@11½c.
" furnace size, arsenical, per unit	11½@12c.
Imported fines, arsenical, per unit.	8½@9c.
" " non-arsenical, per unit	10@10½c.
Pyrite prices are per unit of sulphur. On lump deliveries, a charge of 25c. per ton is made for breaking to furnace size.	
Phosphates.	F. O. B.
*Fla., hard rock	$8 50@9.00
land pebble	5.00@5.50
†Tenn, 78@80%	4.65@4.80
78%	4.00@4.25
75%	4.00@4.50
68@72%	3.50@4.00
‡So. Car. land rock	4.00@4.25
" " river rock	3.75@4.00

Prices for 1906 are merely nominal, as there is practically none to be had.

*F. o. b. Florida or Georgia ports. †F. o. b. Mt. Pleasant. ‡On vessel Ashley River, S. C.

Metal Market.

New York, April 25.

Gold and Silver Exports and Imports.

At all United States Ports in March and year.

Metal.	Exports.	Imports.	Excess.
Gold:			
Mar. 1906	$4,618,627	$5,625,529	Imp. $1,006,902
" 1905	2,392,784	5,133 592	" 2,740,808
Year 1906	18,846,622	10,310,921	Exp. 8,535,701
" 1905	34,015,264	9,222,202	" 24,793,062
Silver:			
Mar. 1906	5,213,811	3,507,532	Exp. 1,706,279
" 1905	4,191,632	2,531,796	" 1,659,836
Year 1906	19,165,608	12,674,692	" 6,490,916
" 1905	12,592,451	6,515,356	" 6,077,096

These statements cover the total movement of gold and silver to and from the United States. The figures are furnished by the Bureau of Statistics of the Department of Commerce and Labor.

Gold and Silver Exports and Imports, N.Y.

For the week ending April 21, and for years from January 1.

Period.	Gold.		Silver.	
	Exports.	Imports.	Exports.	Imports.
Week		$530,306	$929,455	$ 24,078
1906	$3,674,526	4,845,489	21,207,628	603,818
1905	32,440,807	4,486,176	10,382,749	1,136,984
1904	8,306,449	1,607,438	14,277,952	260,969

Imports of gold for the week were chiefly from Germany and Great Britain. Exports of silver were all to London. No gold was exported during the week.

The necessity of heavy transfers to San Francisco has been the main topic of the markets. The coin and bullion in the Mint there was saved, and probably most of the bank coin reserves. The San Francisco situation will be the main point in financial matters for some time to come.

The statement of the New York banks—including all the banks represented in the clearing house—for the week ending April 21, gives the following totals, comparison being made with the corresponding week of 1905:

	1905.	1906.
Loans and discounts	$1,107,294,900	$1,017,429,600
Deposits	1,151,968,600	1,007,464,300
Circulation	44,433,200	51,481,300
Specie	216,166,900	189,653,600
Legal tenders	83,323,300	78,579,200
Total Reserve	$299,440,200	$268,232,800
Legal requirements	287,992,150	251,866,075
Surplus reserve	$11,448,050	$16,366,725

Changes for the week this year were increases of $8,153,800 in loans, $16,948,900 in specie, $1,046,000 in legal tenders, $25,602,700 in deposits, $29,000 in circulation and $11,594,225 in surplus reserve.

The following table shows the specie holdings of the leading banks of the world. The amounts are reduced to dollars:

	Gold.	Silver.	Total.
New York			$189,653,600
England	$168,976,980		168,976,980
France	591,096,540	$210,043,420	801,139,960
Germany	176,145,000	58,715,000	234,860,000
Spain	75,480,000	118,545,000	194,025,000
Netherlands	30,265,500	29,453,500	59,719,000
Belgium	18,630,000	8,815,000	27,445,000
Italy	141,800,000	19,433,500	161,233,500
Russia	450,315,000	24,570,000	474,885,000
Austria	230,560,000	63,885,000	294,445,000

The returns of the associated banks of New York are of date April 21, and the others April 20. The foreign bank statements are from the *Commercial and Financial Chronicle*, of New York. The New York banks do not separate gold and silver in their reports.

Shipments of silver in London to the East are reported by Messrs. Pixley & Abell as follows for the year to April 12:

	1905.	1906.	Changes.
India	£ 2,354,290	£ 5,648,978	I. £ 3,294,688
China	8,070		D. 8,070
Straits	2,800		D. 2,800
Total	£ 2,365,160	£ 5,648,978	£ 3,283,818

Receipts for the week were £2500 from South America and £151,000 from New York; £153,500 in all. Shipments were £272,000 in all, of which £1000 went to Port Said; £223,000 in bars and £48,000 in Mexican dollars to India.

Indian exchange has been a little firmer. India is very prosperous and the demand for money is steady. The Council bills offered in London were taken at an average of 15.97d. per rupee. Buying of silver for India continues.

The movement of gold and silver in Great Britain for the three months ending March 31 was as follows:

Gold:	1905.	1906.
Imports	£ 11,400,817	£ 13,309,701
Exports	5,934,072	6,956,576
Excess, imports	£ 5 466,745	£ 6,353,125
Silver:		
Imports	3,410,599	6,008,619
Exports	3,769,642	6,155,553
Excess exp	£ 359,083	£ 146,934

Of the silver imports this year a total of £5,238,171, or 87.2. per cent. is credited to the United States.

Prices of Foreign Coins.

	Bid.	Asked.
Mexican dollars	$0.50½	$0.51½
Peruvian soles and Chilean	0.46	0.49
Victoria sovereigns	4.85½	4.87½
Twenty francs	3.86	3.89
Spanish 25 pesetas	4 78	4 80

SILVER AND STERLING EXCHANGE.

Apr.	Sterling Exchange.	Silver. New York, Cents.	Silver. London, Pence.	Apr.	Sterling Exchange.	Silver. New York, Cents.	Silver. London, Pence.
19	4.85½	64½	29 1/16	23	4.84¼	65⅝	30⅜
20	4.84	64½	29⅞	24	4.84¼	65¼	30¼
21	4.84	64⅞	30 1/16	25	4.84¼	65⅝	30 7/16

New York quotations are for fine silver, per ounce Troy. London prices are for sterling silver, .925 fine.

Other Metals

Daily Prices of Metals in New York.

April.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. Cts. per lb.	Spelter. New York, Cts. per lb.	Spelter. St. Louis, Cts. per lb.
19	18⅝ @18¾	18¼ @18½	84¾	39	5.35	6.05 @6.10	5.90 @5.95
20	18⅝ @18¾	18¼ @18½	84¾	39	5.50	6.05 @6.10	5.90 @5.95
21	18⅝ @18¾	18¼ @18½	....	39	5.50	6.05 @6.10	5.90 @5.95
23	18⅝ @18¾	18¼ @18½	85	39¼	5.50	6.05 @6.10	5.90 @5.95
24	18⅝ @18¾	18¼ @18½	85¼	39⅝	5.50	6.05 @6.10	5.90 @5.95
25	18⅝ @18¾	18¼ @18⅛	85 7/16	39⅞	5.50	6.05 @6.10	5.90 @5.95

London quotations are per long ton (2,240 lb). standard copper, which is now the equivalent of the former g. m. b's. The New York quotations for electrolytic copper are for cakes, ingots or wirebars. The price of cathodes is usually 0.125c. below that of electrolytic. The lead prices are those quoted by the American Smelting & Refining Co. for near-by shipments of desilverized lead in 50-ton lots, or larger orders. The quotations in spelter are for ordinary western brands; special brands command a premium.

Copper—No business of any consequence has been transacted and the market, therefore, is quiet. The undertone, however, remains as strong as ever. Quotations are 18⅝@18¾c. for Lake; 18¼@18½ for electrolytic in ingots, cakes and wirebars; 18@18⅜ for casting copper.

The London market has ruled very firm, although transactions in prompt copper have diminished somewhat. The bears do not seem to be committed for any further quantities which are deliverable during this month, but are already preparing to cover their May commitments. At the close, the quotations are cabled as £85 8s. 9d. for spot, £83 18s. 9d. for three months.

Refined and manufactured sorts we quote: English tough, £86; best selected, £89; strong sheets, £97.

Exports of copper from New York for the week were 1281 long tons. Our special correspondent reports the exports from Baltimore for the week at 596 long tons of fine copper.

The office of the Quincy Mining Company has been removed to No. 32 Broadway, New York.

The Mountain Copper Company wires us that its main office, formerly in San Francisco, is now at Martinez, California. Its property is uninjured.

Exports and imports of copper in all forms in Great Britain for the three months ending March 31, were as follows, in long tons; the totals giving the contents of all material in fine copper:

	1905.	1906.	Changes.
Copper ore	28,872	24,868	D. 4,004
Matte and precipitate	15,046	19,348	I. 4,302
Fine copper	19,698	18,800	D. 898
Total imports	30,108	30,951	I. 843
Exports	9,402	11,532	I. 2,130
Balance	20,706	19,419	D. 1,287

Of the imports this year, 1051 tons matte and 5172 tons fine copper were from the United States; against 1072 tons matte and 9679 tons fine copper last year.

Imports and exports of copper in Germany for the two months ending Feb. 28 were, in metric tons:

	1905.	1906.	Changes
Imports	15,884	22,770	I. 6,886
Exports	1,937	2,509	I. 572
Balance, imp	13,947	20,261	I. 6,314

Of the imports this year 16,968 tons were from the United States.

Tin—An absolute corner of spot supplies exists both here and in London. This was facilitated by the very small shipments from the Straits, in consequence of which prices are advancing by leaps and bounds. Spot tin in this market is quoted at the close at 39⅞c., while the London quotation is £181 15s. for spot, £179 for three months.

Imports and exports of tin in Great Britain for the three months ending March 31 were as follows, in long tons:

	1905.	1906.	Changes.
Straits	8,365	9,172	I. 807
Australia	876	1,189	I. 313
Other Countries	315	633	I. 318
Total imports	9,556	10,994	I. 1 438
Re-exports	7,373	8,342	I. 969
Exports	1,650	1,789	I. 139
Total exp	9,023	10,131	I. 1,108
Balance	533	863	I. 330

The re-exports were largely of Straits tin to the United States.

Lead—The American Smelting and Refining Company has advanced its price on April 20 by $3 per ton, making the market 5½ at New York and 5.42½ at St. Louis. A good business is doing.

The European market also shows an advance and quotations at the close are cabled as £16 for Spanish lead, £16 2s. 6d. for English lead.

Imports and exports of lead in Great Britain for the three months ending March 31 were as follows, in long tons:

	1905.	1906.	Changes.
United States	4,971	4,274	D. 697
Spain	25,394	25,111	D. 283
Australia	24,864	13,357	D. 11,507
Germany	3,688	3,728	I. 40
Other countries	574	880	I. 306
Total imports	59,491	47,350	D. 12,141
Exports	9,755	11,146	I. 1,391
Balance exp	49,736	36,204	D. 13,532

The lead credited to the United States is chiefly Mexican lead, refined here in bond.

St. Louis Lead Market—The John Wahl Commission Company telegraphs us on April 25, as follows: Lead is strong and advancing. Latest sales of ordinary Missouri brands are at 5.50c. Corroding lead brings 5.55@5.57½c., East St. Louis.

Spanish Lead Market—Messrs. Barrington & Holt report from Cartagena, Spain, under date of April 7, that silver has been 13.75 reales per ounce. Exchange is 29.05 pesetas to £1. Pig lead has been 77 reales per quintal, equal, on current exchange, to £14 16s. 2d. per long ton, f.o.b. Cartagena. Shipments were 636 tons argentiferous to London, and 100 tons desilverized lead to London.

Spelter is quiet but steady, prices being held at about 6.05@6.10 New York, 5.90@5.95 St. Louis.

The London market is somewhat firmer, and quotations are reported as £26 12s. 6d. for good ordinaries, £26 17s. 6d. for specials.

Imports and exports of spelter in Great Britain for the three months ending March 31 were as follows, in long tons:

	1905.	1906.	Changes.
Spelter	21,925	24,652	I. 2,727
Zinc sheets	4,525	4,158	D. 367
Total imports	26,450	28,810	I. 2,360
Exports	2,057	1,665	D. 392
Balance	24,393	27,145	I. 2,752

Imports of zinc ore are not reported separately.,

Exports and imports of spelter in Germany for the two months ending Feb. 28 were as follows, in metric tons:

	1905.	1906.	Changes.
Spelter	10,343	10,242	D. 101
Zinc sheets	2,761	2,789	I. 28
Scrap, etc	781	1,246	I. 465
Total exports	13,885	14,277	I. 392
Imports	3,634	6,265	I. 2,631
Net exports	10,251	8,012	D. 2,239

Exports of zinc-white and lithopone were 3312 tons in 1905, and 5921 tons in 1906; imports being 813 tons in 1905, and 2609 tons in 1906. Exports of zinc ores were 6224 tons in 1905, and 6811 tons in 1906; while the imports were 22,486 tons in 1905, and 30,222 tons this year.

St. Louis Spelter Market—The John Wahl Commission Company telegraphs us on April 25, as follows: Spelter is quiet, but the under-current continues firm. Latest sales here are on a basis of about 5.95c., East St. Louis.

Spanish Zinc Ore Market—Messrs. Barrington & Holt report from Cartagena, Spain, under date of April 7, that the local zinc ore market remains unchanged. Buyers have, however, been able to force down prices a little, but the rates demanded by miners are still too high to allow profitable business when based on the present price of spelter and the low rates of exchange. Shipments for the week were 120 tons of blende to Swansea.

Zinc Sheets—The price of zinc sheets is $7.75 per 100 lb. (less discount of 8 per cent.) f.o.b. cars for Lasalle and Peru, in 600-lb. cases for gages No. 9 to 22, both inclusive; widths from 32 to 60 in., both inclusive, and lengths from 84 to 96 in., both inclusive. The freight rate to New York is 27.5c. per 100 lb. The fluctuations in the base price for sheet zinc since Jan. 1, 1906, have been as follows: Jan. 6, 1906, $8; Feb. 5, $7.75.

Antimony continues very firm, and spot supplies remain scarce. Cookson's is quoted at 23c.; Hallett's, 22½; while other brands can be purchased between 21 and 21½ cents.

Nickel—Quotations for large lots, New York, or other parallel delivery, are 40@47c. per lb., according to size and condition of order. For small quantities, prices range from 48c. up to 60c., also according to size of order and deliveries.

Platinum—The current quotation in New York, is $25 per ounce. The price, however, is subject to fluctuations, on account of variable supply. Demand is strong and steady.

Quicksilver—The metal is firm and New York prices are still $41 per flask of 75 lb. for lots of 100 flasks or over, and $42 for small lots down to 10 flasks. For retail quantities, under 10 flasks, pound prices are charged, which work out to $43.50@44 per flask. San Francisco prices are firm at $39.50 for domestic orders and $38 for export. The London price is £7 7s. 6d. per flask, but jobbers ask £7 10s. for moderate lots.

Imports of quicksilver into Great Britain for the three months ending

March 31 were 1,149,028 lb. in 1905, and 426,882 lb. in 1906, a decrease of 722,146 lb. Re-exports for the three months were 492,895 lb. in 1905, and 628,251 lb. in 1906; an increase of 135,356 lb. this year.

Minor Metals—For minor metals and their alloys, wholesale prices are f.o.b. works.

Aluminum.	Per lb.
No. 1, 99% ingots	35@38c.
No. 2, 90% ingots	33@35c.
Rolled sheets	44c. up
Aluminum casting alloys	30@38c.
Aluminum-bronze powder	90@$1.00
Bismuth	$2 10
Cadmium, 99.5% f. o. b. Hamburg	92c.
Chromium, pure (N. Y.)	80c.
Copper, red oxide	50c.
Ferro-Molybdenum (50%)	95c.
Ferro-Titanium (20@25% N. Y.)	75c.
Ferro-Chrom. (75%)	12½c.
Ferro-Tungsten (37%)	29c.
Magnesium, pure (N. Y.)	$1.60
Manganese (98@98% N. Y.)	75c.
Manganese Cu. (30@70% N. Y.)	40c.
Molybdenum (98@99% N. Y.)	$1.75
Tantalic acid (N. Y.) (oz.)	49c.
Phosphorus, foreign red	75c.
Phosphorus, American yellow	50c.
Tungsten (best), pound lots	90c.

Variations in price are chiefly due to size and conditions of order and deliveries.

Wisconsin Ore Market.

PLATTEVILLE, April 21.

There was not much ore bought during the week, nearly all that was loaded had been purchased, but not loaded, some few weeks ago. The best price of the week was for hand cobbed and roasted ore, $45 for 60 per cent. zinc.

Lead is steady and in good demand, all that was produced being loaded. Drybone and sulphur same price as last week.

The following camps of the Platteville district loaded ore as follows during the week ending April 21:

Camps.	Zinc, Lb.	Lead, Lb.	Sulphur, Lb.
Platteville	469,810	56,540	.....
Cuba City	208,000	.....	.....
Buncombe-Hazel Green	193,500	49,700	.....
Linden	151,830	.....	.....
Livingston	85,000	.....	.....
Mineral Point	83,800	.....	.....
Highland	81,150	.....	.....
Rewey	63,000	.....	.....
Benton	50,000	.....	.....
Montfort	.....	.....	60,000
Total	1,386,090	106,240	60,000
Year to Apr. 21	20,022,240	1,227,360	2,146,400

Several of the plants that were shut down owing to the scarcity of coal are to resume operations next week, there being enough coal in the district to keep them in supply for at least a month. Some of the producers complain of the roads and are not able to get in all the ore that has been piling up in the bins during the bad weather. All the low-grade ore produced has been cleaned up.

Missouri Ore Market.

JOPLIN, April 21.

Renewed activity in the demand for lead increased the shipment of this mineral about 200 tons, and the loading out of a part of the reserve zinc stock, purchased two weeks ago, increased the shipment of zinc 1100 tons, bringing the value of the week's shipment of both ores close to $300,000, being the largest value for one week since Jan. 20. The total district value for this year is a third of a million dollars larger than for the same period of last year. The greater part of the increase comes, however, from lead, which ranges from $12 to $20 per ton higher than a year ago. The higher lead prices are causing prospectors to give more attention to prospecting for lead, and the production is gradually increasing.

With no change in the highest price for lead, yet medium grades of the ore were advanced $2 and $3 per ton. The high price of zinc ore is $2 per ton lower than a week ago and the average selling price is about $1 lower.

Following are the shipments of zinc and lead in pounds by the companies and individuals owning land and first leases in the various camps of the district for the week ending April 21, 1906:

	Zinc, lb.	Lead, lb.	Value.
Carterville-Webb City	2,432,030	699,680	$78,875
Joplin	2,471,000	277,660	64,910
Badger	1,914,210	.....	42,110
Galena-Empire	1,197,180	169,840	30,360
Duenweg	464,610	299 780	21,380
Granby	375,000	60,000	9,300
Prosperity	262,850	85,200	8,887
Aurora	485,200	.....	7,765
Oronogo	271,010	34,480	6,986
Spurgeon	201,100	28,360	6,117
Carthage	206,620	.....	4,648
Stott City	178,610	.....	3,874
Sherwood	117,070	29,060	3,680
Neck City	148,240	.....	3,345
Springfield	128,860	.....	2 834
Alba	112,390	.....	2,527
Playter	41,270	.....	825
Totals	11,107 250	1 684,060	$298,423
Sixteen weeks	157,626,940	22,336,720	$4,313,495
Zinc value, the week, $234 643; 16 weeks,			$3,484,214.
Lead value, the week, 63,780; 16 weeks,			829,281.

The followng table shows the average monthly prices of zinc and lead ores in Joplin, by months; the average for zinc being based on the prices of assay basis ores carrying 60 per cent. zinc:

ZINC ORE AT JOPLIN.			LEAD ORE AT JOPLIN.		
Month.	1905.	1906.	Month.	1905.	1906.
January	52.00	47.38	January	61 50	75.20
February	52.77	47.37	February	57.62	72.83
March	47.40	42.68	March	57.20	73.73
April	42.88	....	April	58.00	....
May	43.31	....	May	58.27	....
June	40.75	....	June	57.80	....
July	43.00	....	July	58.00	....
August	48.83	....	August	58.00	....
September	46.75	....	September	63.50	....
October	47.60	....	October	63.86	....
November	49.55	....	November	68.67	....
December	49.00	....	December	76.25	....

Mining Stocks.

NEW YORK, April 25.

The San Francisco calamity has been the chief topic of the week. The sudden and totally unexpected demand for money in large sums has affected banks and operators alike. It has been a week of general liquidation and consequent lower prices all around. There is also the certainty that the insurance companies will have to sell soon large blocks of securities. These, of course, will be of high-grade, but they will absorb a great deal of purchasing capacity.

Amalgamated Copper touched $106, gaining $2 at the close. American Smelting common sold at $154½; Tennessee Coal, Iron and Railroad brought $144 at the close, while United States Steel was quoted at $42¾ for the common and $108 for the preferred. The increase in Amalgamated Copper dividend to a 7 per cent. yearly rate had no effect, the better dividend prospect being offset by the general liquidation.

The curb market was weak all around, and the copper stocks were rather neglected. There was, however, a slight recovery at the close.

On the Consolidated Exchange, dealings are noted in Alice at $2.70; Elkton at 41c.; Original Bullfrog at 20c.; Comstock at 19c. Trading was not heavy.

Boston. April 24.

It has been a week of liquidation in mining shares and prices were the lowest today. Notwithstanding this fact stocks have been well taken and declines are moderate in comparison to the amount offered for sale.

Amalgamated broke $6.12½ during the week to $106.87½, rallying to $108. The increase in the dividend rate to 7 per cent. per annum shows that the directors feel that the metal market is here to stay for some time to come. North Butte touched $85, closing above $86, against $90.62½ a week back. United Copper broke almost $5 to $62.12½, closing at $63.50. Quincy touched $100 during the week, but has since rallied to $103. Last week's close was $106.50. The company has changed its dividend payments from semi-annual to quarterly periods. The declaration of $2.50 quarterly is at the same rate as paid for 1905. Utah ran off $3.75 to $60.25, but recovered fractionally. Shannon has been in good request by certain parties, and although it was driven off, it easily recovered. Osceola broke $4.75 to $104, closing at $1 above this.

Adventure Mining is off $1 to $6.75. President Messerve is out soliciting proxies for the annual meeting early in June. In a circular he states that work has been prosecuted the past year in opening up the mine. For the first three months of the year sales of 550,864 lb. of copper brought 18.24c., or $100,500. The mining cost was $82,316 and construction $5296, leaving net results of $12,888. Old Dominion is off $2.25 to $42. It is understood that this company will not issue a report for the last fiscal year. Copper Range is off $3.50 to $78.50.

Bingham is off over $3 to $36. Heinze has been at the property, although certain options which he holds on the stock around $39 have not been closed. The time limit is near, but may be extended. Raven Mining has again been the curb

feature, but touched its lowest point today at $3, a decline of $2.37½ during the week. There is talk that the capitalization will be changed and possibly a change made in the management.

Dividends.

Company.	Payable.	Rate.	Amt.
Amalgamated Copper	May 28	$ 1.75	$2 712,500
Boston & Montana		12.00	7,800,000
New Central Coal	May 1	0 40	20,000
Granby Con	May 15	0.30	400,890
International Nickel, pfd.	May 1	1.50	133,689
Montana Ore Pur	Apr. 30	10.00	810,000
Montreal & Boston Copper,	Apr. 7	6.00	750,000
Pennsylvania Steel, pfd	May 1	3.50	688,749
Philadelphia Co	May 1	0.75	434,296
Tenn. C., I. & R. R pfd	May 1	2.00	4,960
Tenn. C., I. & R. R	May 1	1.00	225,536
United Copper	Apr. 30	1 75	767,500
United Copper, pfd	May 15	3.00	150,000

Assessments.

Company.	Delinq.	Sale.	Amt.
Arrow, Utah	May 7	June 1	$0 005
Brewer-Harrison, Utah	May 10	June 1	0.01
Bullion	Apr. 30	May 21	0,05
Brown Stone, Utah	Apr. 22	Apr. 30	0.01¼
Caledonia	Apr. 20	May 11	0.10
Challenge Con	Apr. 17	May 8	0.10
Confidence	Apr. 11	May 2	0.20
Christmas, Utah	Apr. 16	May 5	0.00½
Crown Point, Nev	Apr. 25	May 16	0.10
Idaho-Tonopah, Idaho	Apr. 25	May 14	0.001
Justice	May 17	June 12	0.05
Kismet, Cal	Apr. 20	May 21	0.01½
Kentuck Con	Apr. 11	May 4	0.05
Overman	May 18	June 8	0.10
San Juan Grande	May 12		0.02½
Scorpion	May 3	May 21	0 02
Sierra Nevada	May 7	May 28	0.10
Segregated Belcher	Apr. 5	Apr. 26	0.05
Union Con., Nev	Apr. 10	Apr. 30	0.10
Utah, Nev	Apr. 18	May 9	0.05
Victoria, Utah	Apr. 24	May 15	0.00½
Yellow Jacket	Apr. 20	May 15	0.10

Tonopah Stocks. Apr. 23.

(Revised by Weir Bros. & Co., New York.)

	High.	Low.	Last.
Tonopah Mine of Nevada	18.00	17.75	17.75
Tonopah Montana	2.75	2.70	2.70
Tonopah Extension	12.75	11.50	11.87½
Tonopah Midway	2.10	2.05	2.05
Tonopah West End	3.40	3.30	3.35
Goldfield Mining Co	.52	.50	.52
Jumbo Mining	1.10	1.56	1.60
Red Top	1.70	1.67	1.70
Sandstorm	1.15	1.10	1.12½
Montgomery Shoshone Cons	17.00	16.75	17.00
Eclipse-Bullfrog	1.10	1.05	1.05
Denver-Bullfrog	1.75	1.74	1.75

St. Louis. Apr. 21.

Adams, $0.40—$0.25; American Nettie, $0.20—$0.10; Center Creek, $2.80—$2.50; Central Coal and Coke, $62 00—$60.00; Central Coal and Coke, pfd., $80.00—$78.00; Central Oil, $60.00—$55 00; Columbia, $1.00—$0.25; Con. Coal, $17.50—$10 00; Doe Run (old stock), $350.00 - $300.00; Granite Bimetalic, $0.27—$0.20; St. Joe (old stock), $32.00—$31.00.

LONDON. (*By Cable.**) Apr 25.

Dolores, £1 17s. 6d.; Stratton's Independence, £0 7s. 0d.; Camp Bird, £1 4s. 3d.; Esperanza, £4 2s. 6d.; Tomboy, £1 7s. 6d.; El Oro, £1 6s. 3d.; Oroville, £0 17s. 6d.; Arizona Copper, pf., £3 13s. 0d.; Arizona Copper, def., £3 11s. 6d.

*Furnished by C. Schumacher & Co., New York.

PHILADELPHIA.

Cambria Steel	36	36	35	35¼
Philadelphia Co	49½	50½	47	50
Tonopah	18⅝	18⅝	16¾	18

PITTSBURG.

Crucible Steel	14¾	14¾	14	14
Crucible Steel, Pref.	80⅝	80⅝	70¾	79¾
Tonopah Ext	10¼	11½	10¼	11

STOCK QUOTATIONS.

NEW YORK. Week Apr. 24

Name of Company.	High	Low	Clg.	Sales
Amalgamated	113	106⅝	106⅜	982,350
Anaconda	279½	259½	259½	260,700
Boston Copper	29⅜	21⅜	21⅛	6,700
British Col Copper	7½	7	7	4,310
Federal	175	175	175	100
Federal, Pf	104½	101⅞	102	2,900
Greene Copper	31¼	29	29	19,255
Greene Gold	3	2⅞	3	4,400
Mitchell	11¼	9½	10⅜	8 122
Tennessee Copper	47⅛	43	43	3,450
Union Copper	2 7/16	1 13/16	2	36,000
United Copper	68⅝	61⅞	61⅞	25,200
Utah Apex	6	6	6	100
Utah Copper	28¼	23½	23½	5,060

NEW YORK INDUSTRIALS.

Am. Smelting & Ref.	160⅛	163¼	153⅛	186,315
Am. Smelting & Ref., Pf.	120	117½	117½	5,000
Col. Fuel & Iron	62	57	57	75,350
Pittsburg Coal	14⅝	14	14	600
" " pfd	57	56	57	300
National Lead	83⅛	77¾	77¾	35,745
Republic I. & S.	31½	28½	28½	13,450
Republic I. & S., Pf	102¾	99	99	7,750
Tenn. C. & I.	145⅛	144	144	3,000
U. S. Red. & Ref.	34	29	30¼	4,050
U. S. Red. & Ref., Pf.	70¼	65	67	2,520
U. S. Steel	43¾	41⅝	41⅝	678,760
U. S. Steel, Pf.	109	106⅛	106⅛	171,350
Standard Oil	656	643	645	
Bethlehem Steel	29½	26	26¾	

These stocks, not elsewhere quoted, had the following range of prices during the week: (New York) Bamb. Delamar, 6¼—7; Butte Coalition, 34½—37⅜; Cumb. Ely Min., 6½—6⅞; Greene Gold-Silver, 2½—3; Mont. Shoshone, new, 16—16½; Nevada Con. Copper, 18¼—20. (Boston) Adventure, 6¾—7¼; Montana C. & C., 3¼—4; Nevada, 18½—20; Trinity, 10¼—11⅝; U. S. Oil, 12—12½; Wolverine, 135 - 139½; Wyandotte, 1¼—1¾.

BOSTON.

Allouez	40½	37	37	2 210
Amalgamated	113	106⅞	106⅞	65,198
Atlantic	20⅛	18½	18½	1,585
Bingham	39⅛	36	36	7,825
Boston Consolidated	24	21	21	5,770
*Calumet & Hecla	710	700	700	48
Centennial	26½	24½	24½	1,060
Mercur	65	62	62	2,375
Copper Range	82⅛	78	78	8,928
Daly-West	17½	15	15⅛	2,099
Franklin	17¾	16½	16½	4,915
Granby	13	12½	12½	769
*Green Con. Copper	31⅝	29	29	7,227
Isle Royale	22⅛	20	20	1,630
Mass	8¾	8¼	8¼	505
Michigan	14	13	13	160
Mohawk	61	58¾	58⅜	1,849
*North Butte	90½	85	85	23,958
Old Dominion	44	41½	41½	2 627
Osceola	108⅛	104	104	3,928
Parrot	39	36⅛	36⅛	3,915
Quincy	106½	100	102½	630
Rhode Island	5⅛	4½	4½	735
Shannon	8	7⅛	7⅛	7,232
Tamarack	108	107	107	343
Tecumseh	11½	9½	9½	1,155
*United Copper, com	66⅞	61¾	61¾	13,595
U. S. Smg. & Ref.	61½	58	58	8,804
* " " pfd	46⅝	45¾	45⅞	4,718
Utah	64	60¼	60¼	9,359
Victoria	8⅛	8	8¼	650
‡Winona	8	7	7	462

COLORADO SPRINGS.

Name of Company.	First	High	Low	Clg
Elkton	43½	45	40	40
El Paso	52¾	52¾	50	50¼
Isabella	27	27	26	26
Portland	190	190	180	180
Vindicator	100	102	90	94

SAN FRANCISCO.

(Business suspended for the present; last figures left for reference.)

Best & Belcher	1.25	1.25	1.15	1.15
Bullion	.31	.31	.25	.29
Caledonia	.37	.44	.35	.44
Confidence	.90	.94	.90	.90
Con. Cal. & Va	1.35	1.35	1.30	1.30
Gould & Curry	.28	.28	.27	.27
Hale & Norcross	1.20	1.20	1.05	1.10
Mexican	1.15	1.15	1.15	1.15
Occidental Con	.96	.96	85	.95
Ophir	5.37½	5.50	5 25	5.25
Savage	1.00	1.00	1.00	1.00

*Ex-dividend. †1st Installment Paid.
‡Assessment Paid. §2d Installment Paid.

Monthly Average Prices of Metals.

SILVER.

Month.	New York.		London.	
	1905.	1906.	1905.	1906.
January	60.690	65.288	27.930	30.113
February	61.023	66.108	28.047	30.464
March	58.046	64.597	26.794	29.854
April	56.600	.....	26.108	.....
May	57.832	.....	26.664	.....
June	58.428	.....	26.910	.....
July	58.915	.....	27.163	.....
August	60.259	.....	27.822	.....
September	61.695	.....	28.528	.....
October	62.034	.....	28.637	.....
November	63.849	.....	29.493	.....
December	64.850	.....	29.977	.....
Year	60.352	.....	27.839	.....

The New York prices are in cents per fine ounce; the London quotation is in pence per standard ounce, .925 fine.

COPPER.

	New York.				London.	
	Electrolytic.		Lake.			
	1905.	1906.	1905.	1906.	1905.	1906.
Jan	15.008	18.310	15.128	18.416	68.262	78.896
Feb	15.011	17.869	15.136	18.116	67.963	78.147
March	15.125	18.361	15.250	18.641	68.174	81.111
April	14.920	.....	15.045	.....	67.017	.....
May	14.627	.....	14.820	.....	64.875	.....
June	14.673	.....	14.813	.....	65.881	
July	14.888	.....	15.005	.....	66.887	.....
Aug	15.664	.....	15.725	.....	69.830	.....
Sept	15.965	.....	15.978	.....	69.667	.....
Oct	16.279	.....	16.332	.....	71.406	.....
Nov	16.599	.....	16.758	.....	74.727	.....
Dec	18.328	.....	18.398	.....	78.993	.....
Year	15.590	.....	15.699	.....	69.465	.....

New York prices are in cents per pound. Electrolytic quotations are for cakes, ingots or wire bars. The London prices are in pounds sterling, per long ton of 2,240 lb., standard copper.

TIN IN NEW YORK.

Month.	1905.	1906.	Month.	1905.	1906.
Jan	29.325	36.390	July	31.760	....
Feb	29.262	36.403	August	32.866	.....
March	29.523	36.662	Sept	32.995	.....
April	30.525	.....	Oct	32.481	.....
May	30.049	.....	Nov	33.443	.....
June	30.329	.....	Dec	35.835	.....
			Av. year.	31.358	.....

Prices are in cents per pound.

LEAD IN NEW YORK.

Month.	1905.	1906.	Month.	1905.	1906.
Jan	4.552	5.600	July	4.524	....
Feb	4.450	5.464	Aug	4.665	....
March	4.470	5.350	Sept	4.850	.....
April	4.500	.....	Oct	4.850	.....
May	4.500	.....	Nov	5.200	.....
June	4.500	.....	Dec	5.422	.....
			Av., year.	4.707	.....

Prices are in cents per pound. The London average for January, 1906, was £ 16.850 per long ton; February, £ 16.031; March, £ 15.922.

SPELTER.

Month.	New York.		St. Louis.		London.	
	1905.	1906.	1905.	1906.	1905.	1906.
Jan	6.190	6.487	6.032	6.337	25.062	28.225
Feb	6.139	6.075	5.989	5.924	24.594	25.844
Mar	6.067	6.209	5.917	6.056	23.825	24.563
April	5.817	.....	5.667	.....	23.813	.....
May	5.434	.....	5.284	.....	23.594	.....
June	5.190	.....	5.040	.....	23.875	.....
July	5.396	.....	5.247	.....	23.938	.....
Aug	5.706	.....	5.556	.....	24.675	.....
Sept	5.887	.....	5.737	.....	26.375	.....
Oct	6.087	.....	5.934	.....	28.225	.....
Nov	6.145	.....	5.984	.....	28.500	.....
Dec	6.522	.....	6.374	.....	28.719	.....
Year	5.882	.....	5.730	.....	25.433	.....

New York and St. Louis prices are in cents per pound. The London prices are in pounds sterling per long ton (2,240 lb.) good ordinary brands.